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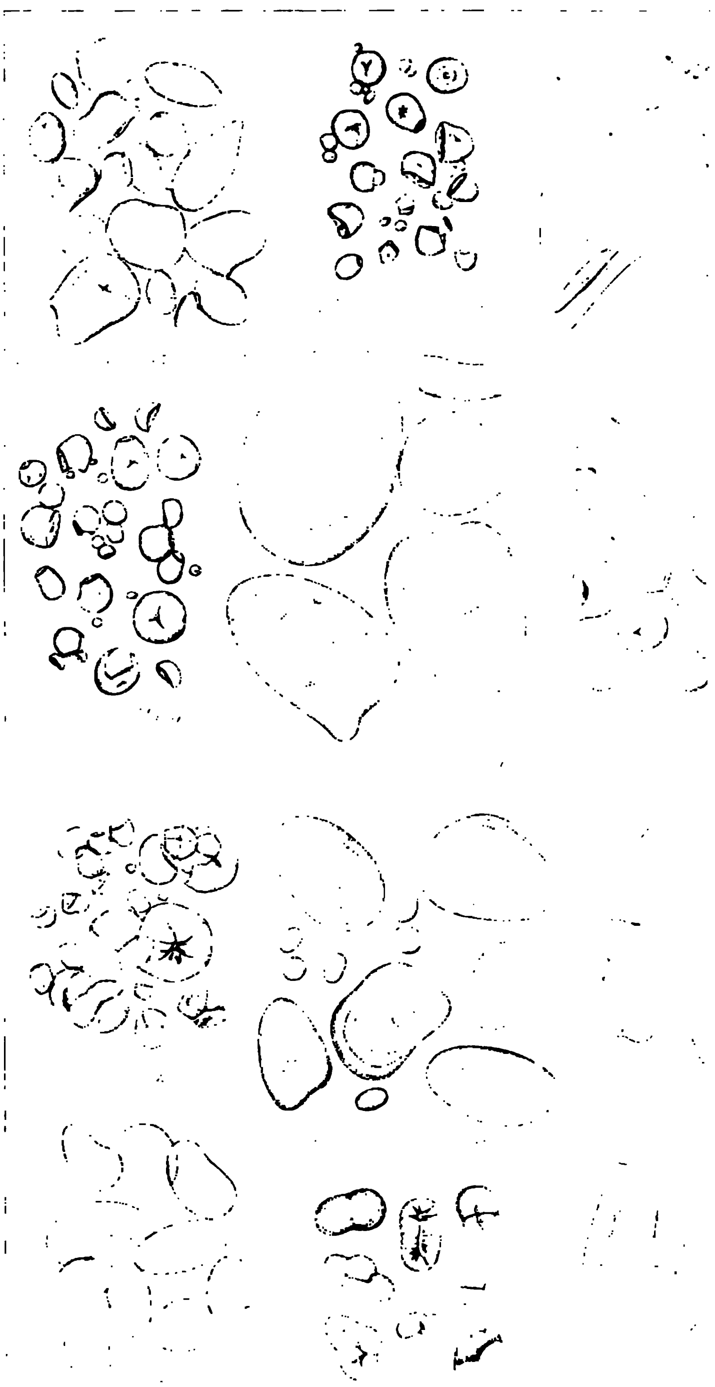

THE

ELEMENTS

OF

MATERIA MEDICA

AND

THERAPEUTICS.

BY

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AND PHYSICIAN TO THE LONDON HOSPITAL.

Fourth Edition,
ENLARGED AND IMPROVED,
INCLUDING
NOTICES OF MOST OF THE MEDICINAL SUBSTANCES IN USE IN THE
CIVILISED WORLD,
AND FORMING AN
Encyclopædia of Materia Medica.

VOL. II. PART II.

LONDON:
LONGMAN, BROWN, GREEN, LONGMANS, AND ROBERTS.
1857.

LANE LIBRARY

421

LONDON:
Printed by SPOTTISWOODE & Co.
New-street Square.

P43
v.2, pt.2
1857

PREFACE.

By the publication of this volume the fourth edition of the Elements of Materia Medica and Therapeutics is brought to a completion. The Author died while the third edition of the present volume was passing under his revision; and it devolved upon the Editors to complete that which he had commenced. In the short period of three years a new edition has been called for; and in this second revision of the volume, the Editors have endeavoured to improve the work, both in matter and arrangement. The additions made on the present occasion amount to nearly one hundred pages. They include twenty new articles and fifteen additional illustrations. The articles on CHLOROFORM and COD LIVER OIL have been re-written. Numerous additions have been made to the sections on the vegetable alkaloids and principles, some of which are for the first time described in this volume. These will be found under the articles *Conia, Cotarnine, Opianine, Opianic Acid, Narcogenine, Papaverine, Helleborine, Aconitine, Berberine,* and other similar compounds. The reader will also find, in their appropriate places, short notices of *Amylene* and *Pepsine,* two substances which have been quite recently introduced into medical practice. To the pharmaceutical compounds described in the previous editions many new preparations have been added from the Pharmacopœias of Norway and the United States. The Editors have also transferred to

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this volume various new articles of Materia Medica but little known in this country, which have been incorporated with the third American edition by Dr. Carson.

The volume has been separately paged, and is provided with a separate index. Some articles which more appropriately belonged to other parts of the work, have been transferred to the other volumes. In spite of this it will be perceived that there is a great increase of matter, both in the text and in the notes. Acting upon the rule which they have hitherto pursued, the Editors have not interfered with the views of the Author; they have simply added in brackets such notes and remarks as appeared to them to be required in the present state of science. The fourth edition of this standard scientific work now comprises upwards of two thousand five hundred pages, including five hundred and eighty-six articles of Materia Medica, of which one hundred and ninety-eight are contained in the first volume, under the head of MINERAL SUBSTANCES, and three hundred and eighty-eight in the two parts of the second volume, comprising VEGETABLE AND ANIMAL SUBSTANCES. These are illustrated by four hundred and seventy-eight engravings. Of the value of the matter thus contributed to the medical literature of the day, th
Editors feel themselves at liberty to speak, since the Author is n
no more, and they have merely aided in carrying out his vie
Their opinion is the expression of the opinion of the whole profess
both in this and foreign countries,—namely, that in copiousnes
details, in extent, variety, and accuracy of information, and in a l
explanation of difficult and recondite subjects, it surpasses all
works on Materia Medica hitherto published. The history of a
as it is given in these volumes, is not a dry description of its p
characters and its medicinal uses. Philology, Natural History,
Chemistry, Physics, and the Microscope, are all brought fo

elucidate the subject; and the reader thus acquires a full scientific knowledge of each article of Materia Medica before he is introduced to a description of its effects on plants, animals, and man, or to the various theories of its operation, and the different uses to which it has been applied in ancient and modern times. It is a peculiar feature in the writings of the Author,—one which is stamped upon every page of this treatise,—that he was not satisfied until he had thoroughly exhausted the subject. His references to ancient and modern authorities are constant and numerous: he has gone to all sources which are capable of yielding information, and has fairly acknowledged his obligations to those by whose learning, experience, or research, he has profited. He has thus succeeded in transforming the substance of an unpretending course of lectures into a complete Encyclopædia of Materia Medica.

That the labours of the Author are fully appreciated by the profession is proved by the fact that, since his decease, within the short period of four years a new edition of each volume has been called for, and two editions of the present volume have issued from the press.

ALFRED SWAINE TAYLOR.
GEORGE OWEN REES.

London, May 1857.

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Page 207, Line 21 from foot, in preparation 4, *for* Compositæ, *read* Composita.
Page 282, Line 22 from foot, in preparation 2, *for* Prunæ, *read* Pruni.
Page 531, Line 26 from foot, in preparation, *for* Pilulæ Cambogiæ Compositæ, *read* Pilula Cambogiæ Composita.
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ELEMENTS

OF

MATERIA MEDICA.

SUB-DIVISION III. CALYCIFLORÆ, *De Cand.*

Calyx gamosepalous, i. e. *sepals more or less united at the base. Torus more or less adnate to the inside of the calyx at the base. Petals and stamens inserted into that part of the torus adnate to the calyx, and, therefore, commonly said to arise from the calyx. Petals free or united. Ovary free or adnate to the calyx.*

ORDER LI. PYROLACEÆ, *Lind.*—WINTER-GREENS.

CHARACTERS.—*Calyx* free, 4–, more frequently 5–partite, persistent. *Petals* 5, free or cohering, perigynous? with an imbricated æstivation. *Stamens* twice the number of the petals, to which they are not adherent; *anthers* bilocular, dehiscing by 2 pores. *Ovarium* 3– to 5–celled, seated on a hypogynous disk. *Style* 1. *Stigma* roundish or lobed, sometimes slightly indusiate. *Capsule* 3– to 5–celled, 3– to 5–valved, loculicidal-dehiscent. *Placentæ* adherent at the centre. *Seeds* indefinite, minute, with a pellicle indusiate or winged. *Embryo* minute, at the base of fleshy albumen, with moderately distinct cotyledons.—*Herbs,* natives of the northern atmosphere, perennial or scarcely *under-shrubs,* smooth. *Stems* round, naked, or leafy. *Leaves* simple, entire or dentate. *Flowers* racemose, somewhat umbellated, rarely solitary, white or rose-coloured. (*De Cand.*)

PROPERTIES.—In structure, proximate principles, and medicinal properties, this order is allied to Ericaceæ. Its prevailing principles are bitter, resinous, and astringent substances.

214. CHIMAPHILA UMBELLATA, *Nuttall.*—PIPSISSEWA; UMBELLATED WINTER-GREEN.

Chimaphila corymbosa, *Pursh.*—Pyrola umbellata, *Linn.*

Sex. Syst. Decandria, Monogynia.

(Herba, *L.*—Herb, *E. D.*)

HISTORY.—The Pipsissewa was employed medicinally by the aborigines of America. It was first described and figured by Clusius,[1] who termed it *Pyrola* 3 *vel frutescens;* and it was introduced to the notice of the profession, in 1803, by Dr. Mitchell.[2] Monographs on it have been published by Elias Wolf,[3] and by Radius.[4] Its generic name is derived from χεῖμα, *winter,* and φίλος, *a friend.*

---

[1] *Historia Pannonica.*

[2] *Inaug. Diss.* Philad. 1803.

[3] *Diss. de Pyrola umbell.* Goett. 1817.

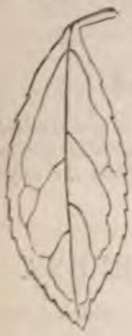
[4] *Dissert. de Pyrola et Chimoph.* Spec. i. 1821; Spec. ii. 1829.

BOTANY. **Gen. Char.**—*Calyx* 5-cleft. *Petals* 5, spreading, deciduous. *Stamens* 10, 2 in front of each petal; *filaments* dilated in the middle. *Ovarium* rounded-obconical, obtusely angular, umbilicated at the apex. *Style* very short, concealed in the umbilicus of the ovary. *Stigma* orbicular, tuberculated, 5-crenate. Cells of the *capsule* dehiscent at the apex; the valves not connected by tomentum (*De Cand.*)

Sp. Char.—*Filaments* smooth. *Bracts* linear-awl-shaped. *Leaves* cuneate-lanceolate, of the same colour (*De Cand.*)

A perennial *under-shrub*. *Rhizome* woody, creeping. *Stems* ascending, somewhat angular, marked with the scars of former leaves. *Leaves* in irregular whorls, evergreen, coriaceous, on short petioles, serrate, smooth, shining. *Flowers* nodding in a small corymb. *Corolla* white, tinged with red, having an agreeable odour.

FIG. 1.



Hab.—Woods of Europe, Asia, and more frequently North America.

DESCRIPTION.—The officinal parts are the leaves (*folia chimaphilæ* seu *pyrolæ*), or rather the leaves and the stems (*herba chimaphilæ* seu *pyrolæ*). The fresh leaves exhale a peculiar odour when bruised: their taste is bitter and astringent. The infusion of the dried herb is rendered green (*tannate of iron*) by sesquichloride of iron, and very slightly turbid by a solution of isinglass.

Chimaphila maculata, or *spotted winter-green*, probably possesses similar virtues to the *C. umbellata*. "The character of the leaves of the two plants will serve to distinguish them. Those of C. maculata are lanceolate, rounded at the base, where they are broader than near the summit, and of a deep olive-green colour, veined with greenish white; those of the officinal species are broadest near the summit, gradually narrowing to the base, and of a uniform shining green. In drying, with exposure to light, the colour fades very much, though it still retains a greenish hue" (Wood[1]).

COMPOSITION.—This plant has been analysed by Elias Wolf and by Fr. Martens:[2] their results are as follows:—

Wolf's Analysis.	
Bitter extractive	18·00
Resin	2·40
Tannin	1·38
Woody fibre, with a small proportion of gum and vegetable calcareous salts	78·22
	100·00

Marten's Analysis.	
Bitter gummy extractive, with a small quantity of tannin and some vegetable calcareous salts	16·05
Oxidised extractive	1·25
Soft resin and chlorophylle	3·00
Balsamic hard resin	5·30
Tannin with gallic acid	3·30
Woody fibre	63·60
Moisture and loss	7·50
	100·00

The activity of the plant resides, in part at least, in the *bitter extractive*, *resin*, and *tannic acid*; but it is probable that there is also some volatile constituent (*essential oil?*) in the fresh plant to which the medicinal properties of the plant are in part due.

PHYSIOLOGICAL EFFECTS.—The fresh leaves appear to possess considerable acridity, depending, probably, on some volatile constituent; for

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[1] *United States Dispensatory.*

[2] Martiny, *Encyklop. d. med. pharm. Natural u. Rohwaarenkunde*, Bd. i. p. 753, 1843.

Dr. Barton says, that, when bruised, they produce rubefaction, vesication, and desquamation, if applied to the skin.

The infusion of the dried leaves, when swallowed, acts as a tonic, producing an agreeable sensation in the stomach, and assisting the appetite and digestive process. It promotes the action of the secreting organs, more especially the kidneys, over which, indeed, it has appeared to exercise a specific influence; increasing the quantity of urine; diminishing, as some have imagined, the quantity of lithic acid or lithates secreted; and beneficially influencing several forms of chronic nephritic disease. Indeed, this plant possesses, in its medicinal as well as its natural-historical and chemical relations, qualities analogous to those belonging to Uva-ursi.

USES. — The following are the principal diseases in which it has been employed: —

1. *In dropsies*, accompanied with great debility and loss of appetite, it is useful as a diuretic, as well as on account of its stomachic and tonic qualities. It was introduced to the notice of practitioners in this country, as a remedy for this class of diseases, by Dr. W. Somerville.[1] Dr. Beatty[2] has also found it useful in this disease.

2. *In chronic affections of the urinary organs.* — Pyrola has been found serviceable in the various disorders of the urinary organs, in which the Uva-ursi frequently proves beneficial; such as cystirrhœa and calculous complaints. It has occasionally alleviated some cases of hæmaturia, ischuria, dysury, and gonorrhœa.

3. *In scrofula.* — We can readily believe that, as a tonic, this remedy may be useful in various forms of scrofula. But it has been supposed by some to possess almost specific powers; and in America its reputation is so high, that in the provinces it acquired the title of "*King's Cure.*" Dr. Paris[3] says that "an irregular practitioner, who has persuaded a number of persons in this metropolis that he possesses remedies obtained from the American Indians, by which he is enabled to *cure* scrofula in its worst forms," relies for success on chimaphila. In some ill-conditioned scrofulous ulcers pyrola is used in the form of a wash.

ADMINISTRATION. — Chimaphila is given in the form of *decoction* or *extract:* the latter has been employed in doses of ten or fifteen grains.

DECOCTUM CHIMAPHILÆ, L.; *Decoctum Pyrolæ*, D; *Decoction of Umbellated Winter-Green.* (Chimaphila, ℥j.; Distilled Water, Oiss. Boil down to a pint and strain, *L.* — The *Dublin College* orders of Leaves of Winter-Green, dried, ℥ss.; Water, Oss. Boil for ten minutes in a covered vessel, and strain.) — Dose, f℥j. to f℥ij.

ORDER LII. ERICACEÆ, *Lindley.* — HEATHWORTS.

ERICÆ, *Juss.* — ERICEÆ, *R. Brown.*

CHARACTERS. — *Calyx* 4- or 5-partite, almost equal, entirely unadherent to the ovary, persistent. *Corolla* perigynous, or somewhat hypogynous, gamopetalous, 4- or 5-partite, or with 4 or 5 distinct petals, regular or more rarely irregular petals imbricated by æstivation. *Stamens* definite, equal or double in number to the petals, entirely or almost free from the corolla. *Anthers* 2–celled; cells hard, dry, separate either at the apex or base, often furnished with some appendage, dehiscing by a terminal pore. *Ovary* free, surrounded at the base by a disk, which is sometimes nectariferous. *Style* single, rigid. *Stigma* undivided, toothed, or 3–lobed. *Fruit* capsular, many-seeded, many-celled; dehiscence varies. *Seeds* inserted in a central placenta, small, indefinite; the *testa* firmly adhering to the nucleus. *Embryo* round; in the axis of fleshy albumen; the radicle opposite to the hilum.—*Shrubs* or *under-shrubs*, rarely small *trees*. *Leaves* alternate, rarely somewhat opposite or verticillate, without stipules, usually rigid, entire, evergreen, articulated on the stem. (*De Cand.*)

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[1] *Med.-Chir. Trans.* v. 340.

[2] *Trans. of the King and Queen's Coll. of Phys., Ireland*, vol. iv. p. 23.

[3] *Pharmacologia.*

Properties.—The medicinal qualities of the officinal heathworts are due to tannic acid (as in Uva-ursi), and to volatile oil (as in *Gaultheria procumbens*). In the tribe *Rhodoreæ* are found several species remarkable for their narcotic and poisonous properties; as *Kalmia latifolia*, *Rhododendron chrysanthum*, and *Azalea pontica*. The poisonous properties of Trebizond honey are due to the latter plant (see *Honey*).

215. ARCTOSTAPHYLOS UVA-URSI, *Sprengel.*—THE BEAR-BERRY.

Arbutus Uva-ursi, *Linn.*

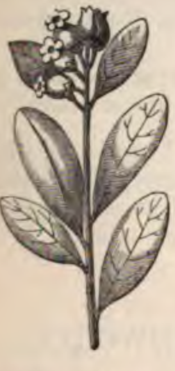
Sex. Syst. Decandria, Monogynia.

(Folium, *L.*—Leaves, *E. D.*)

History.—Some doubt exists whether this plant was known to the ancient Greeks and Romans. Bauhin[1] and some others think that it is the ἰδαία ῥίζα of Dioscorides;[2] but the leaves are very unlike those of *Ruscus aculeatus* (ὀξυμυρσίνη), to which he, as well as Pliny,[3] compares them. The ἄρκτου σταφυλή of Galen agrees better with the Uva-ursi, though the short description of it applies also to Ribes rubrum.[4]

Botany.—**Gen. Char.**—*Calyx* 5-partite. *Corolla* ovate-urceolate; the mouth 5-toothed, revolute, short. *Stamens* 10, inclosed; *filaments* somewhat dilated at the base, hairy-ciliate; *anthers* compressed, with 2 pores at the point, laterally 2-awned, awns reflexed. *Ovarium* globose-depressed, surrounded with 3 scales; *style* short; *stigma* obtuse. *Berry* (or berried drupe) globose, 5-, rarely 6-, 7-, or 10-celled; cells 1-seeded (*De Cand.*)

Fig. 2.



Sp. Char.—Procumbent. *Leaves* coriaceous, persistent, obovate, quite entire, shining. *Flowers* disposed in terminal small racemes. *Bractlets* beneath the pedicles, obtuse, small (*De Cand.*)

Stems woody, round, and trailing. *Leaves* alternate, stalked, evergreen; convex and wrinkled above; concave and paler beneath. *Bractlets* coloured. *Sepals* pale-reddish, permanent. *Corolla* rose-coloured, smooth. *Berry* globose, scarlet, mealy within, very austere, and astringent. *Seeds* seldom more than 4 or 5, though there are the rudiments of 8 or 10.

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[1] *Pinax*, p. 470.
[2] Lib. iv. cap. 44.
[3] *Hist. Nat.* lib. xxvii. cap. 69, ed. Valp.
[4] Murray, *De Uva-ursi: Opuscula*, 19–20.

Hab. — Indigenous. Northern parts of Europe, Asia, and America. On dry, stony, and alpine heaths.

DESCRIPTION.—The dried leaves (*folia uvæ-ursi*) are of a dark, shining, green colour, and have a bitter astringent taste, but no odour. Their under surface is reticulated.

The leaves of *Vaccinium Vitis Idæa* (*Red Whortleberry*) are said to be occasionally substituted for those of Uva-ursi. The fraud (which is unlikely to occur in this country) may be detected by the edges of the leaves being minutely toothed, and the under surface dotted; whereas the edges are entire, and the under surface reticulated, in the genuine leaves. Furthermore, the false leaves are deficient in astringency, and their watery infusion is coloured green by sesquichloride of iron, but does not form any precipitate with gelatine; whereas the true ones are highly astringent, and their watery infusion forms a blackish-blue precipitate with the sesquichloride of iron.[1]

COMPOSITION. — Uva-ursi leaves were analysed, in 1809, by MM. Melandri and Moretti,[2] and in 1827 by Meissner.[3] The constituents in 103 parts are, according to the last-named chemist, *gallic acid* 1·2, *tannic with some gallic acid* 36·4, *resin* 4·4, *oxidised extractive, with some citrate* (?) *of lime* 0·8, *gum with supermalates of lime and soda, and traces of tannin and common salt,* 3·3, *chlorophylle* 6·3, *gum* (*pectic acid?*) *extracted by potash* 15·7, *extractive obtained by potash* 17·6, *lignin* 9·6, *and water* 6·0 (excess 1·3).

PHYSIOLOGICAL EFFECTS. α. *On Animals generally.*—Most animals refuse to eat this plant: there are, however, some few exceptions to this statement. Birds, it is said, will eat the berries; and Murray[4] tells us that two kinds of insects feed on the plant, one of which (a species of Coccus) yields a crimson dye. Girardi[5] found that an infusion of the leaves might be injected into the urinary bladder of animals with impunity; but, when taken internally, it excited vomiting and contraction and inflammation of the stomach.

β. *On Man.*—The obvious effects of Uva-ursi are those of the vegetable astringents before described. Its activity as an astringent depends on tannic and gallic acids. The former of these acids, in its passage through the system, becomes oxidised and converted into gallic and pyrogallic acids, and humus-like substances, which communicate a dark colour to the urine.

Uva-ursi slightly augments the quantity, and also somewhat modifies the quality, of the urine. Alexander[6] found that ʒss. of the powder acted as a mild diuretic; and I have frequently seen lithic deposits in the urine lessened under its use. In large doses the powder readily nauseates.

USES.—As an astringent, it is applicable to all the purposes for which the vegetable astringents generally are used. It has been employed as an antidote in poisoning by ipecacuanha (see *Ipecacuanha*). But the principal use of this remedy is in *chronic affections of the bladder*, attended with increased secretion of mucus, and unaccompanied with any marks of active inflammation. Thus, in the latter stages of catarrhus vesicæ, the continued use of Uva-ursi is frequently most beneficial. Combined with hyoscyamus, says Dr. Prout,[1] and persevered in steadily *for a considerable time*, it seldom fails to diminish the irritation and quantity of mucus, and thus to mitigate the sufferings of the patients. "It undoubtedly possesses," he adds, "considerable powers in chronic affections of the bladder, *for which only it is adapted*, its operation being slow and requiring perseverance." Sir Benjamin Brodie,[2] on the other hand, observes that "Uva-ursi has the reputation of being useful in some cases of chronic disease of the bladder, and in this [inflammation] among the rest. I must say, however, that I have been disappointed in the use of Uva-ursi, and that I have not seen those advantages produced by it which the general reputation of the medicine had led me to expect. I have seen much more good done by a very old medicine"—the root of the Cissampelos Pareira. Such are the opposite statements of the effects of this remedy, made by two of the most eminent writers on diseases of the urinary organs. My own experience of it amounts to this: that in some cases the relief obtained by the use of it was marked; whereas, in other instances, it was of no avail. It is to be remembered that its astringent operation unfits it for acute cases, and that the alteration which it produces in the condition of the urinary organs is affected very slowly; so that, to be beneficial, it requires to be exhibited for a considerable period. *In calculous affections* it has occasionally given relief. De Haen[3] and Van Swieten[4] speak of the good effects of it in these cases. It alleviated the pain, checked the purulent and mucous secretion, and restored the urine to its natural condition. These effects seem to have arisen from its influence over the kidneys and bladder, for it did not appear to affect the calculus. I have already stated that it has appeared to me to lessen lithic deposits in the urine. In *chronic bronchial affections*, with profuse mucous or purulent secretion, it may occasionally prove serviceable. Dr. Bourne[5] gave it in powder (in doses of from 8 to 20 grs.) three times daily, in milk, with success. [Mr. Harris, in the Virginia Medical Journal, has recommended Uva-ursi as a substitute for ergot of rye in protracted labour.—Ed.]

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[1] See Braconnot, *Bull. de Pharm.* iii. 348; and Bouillon-Lagrange, *Ann. de Chim.* lv. 46.

[2] *Bull. de Pharm.* i. 59.

[3] Gmelin, *Handb. d. Chem.* ii. 1294.

[4] *Opuscula*, p. 98.

[5] *De Uva Ursina* [Sandifort, *Thesaurus*, ii. 453], Patavi, 1764.

[6] *Exp. Essays*, p. 151.

Administration.—The dose of the *powder* is from ℈j. to ʒj. But the "powdered leaves of this plant are so bulky and disagreeable, that few stomachs will bear to persevere long enough in the use of the requisite quantity; and the case is pretty much the same with the *infusion* and *decoction*."[6] On this account the *extract* is frequently preferred.

1. DECOCTUM UVÆ URSI, L. D.; *Decoction of Bear-berry.* Uva-ursi, ℥j.;

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[1] *On Affect. of the Urinary Organs*, pp. 185 and 268, 2d edit. 1825.

[2] *Lond. Med. Gaz.* vol. i. p. 300.

[3] *Rat. Med.* t. ii. p. 63.

[4] *Commentaries*, t. xvi. p. 300.

[5] *Cases of Pulmonary Consumption*, &c. *treated with Uva-ursi*, 1805.

[6] Prout, *op. cit.* p. 185.

Distilled Water, Oiss. Boil down to a pint and strain, *L.*—The *Dublin College* orders of Uva-ursi, ℥ss.; Water, Oss. Boil for ten minutes in a covered vessel, and strain.)—Dose, f℥j. to f℥iij. three times a day.

2. **EXTRACTUM UVÆ URSI.**, L.; *Extract of Bear-berry.* (Uva-ursi, bruised, lb. iiss.; Boiling Distilled Water, Cong. ij. Macerate for twenty-four hours; then boil down to a gallon, and strain the liquor while hot; lastly, evaporate to a proper consistence.)—Dose, grs. v. to grs. xv. twice or thrice daily.

216. Gaultheria procumbens, *Linn.*—Partridge-Berry.

Sex. Syst. Decandria, Monogynia.

(Leaves.)

Gautiera repens, Rafinesque,[1] Med. Fl. of the United States. In different parts of the United States it is known by different names; as *Grouse-berry*, *Deer-berry*, *Spice-berry*, *Tea-berry*, *Mountain-tea*, *Winter-green*, *Box-berry*, &c.

A small shrubby evergreen. Stem prostrate, smooth; with ascending branches. Leaves obovate, with setaceous serratures, acute at either end. Pedicels bearing 1–2 nodding flowers. Calyx 5–lobed, white. Corolla white, urceolate. Capsule small, 5–celled, inclosed within the fleshy calyx, and presenting the appearance of a bright scarlet berry. Grows in America from Canada to Virginia.

The leaves and other parts of the plant contain a peculiar volatile oil (*oil of partridge-berry*, or *oil of winter-green*), to which their aromatic qualities are due. The leaves also contain *tannin*.

The leaves are aromatic, stimulant, and astringent. In infusion they have been employed, under the name of *Mountain* or *Salvador Tea*, as a substitute for China tea. Like some other stimulants, they have been thought to promote the catamenia and milk. As astringents, they have been used in chronic diarrhœa. But they are chiefly employed on account of their agreeable flavour, and to yield the essential oil.

The *volatile oil of partridge-berry* (*oleum gaultheriæ*, Ph. United States) has occasionally been imported, and sold in England under the name of *oil of winter-green*. It is obtained chiefly in New Jersey, by submitting the leaves of the plant to distillation with water. As usually met with in commerce, it has a brownish-yellow, or pinkish colour: that which I have met with in England was pinkish-yellow. By redistillation it becomes colourless. It is the heaviest of all the volatile oils; its sp. gr. being 1·173 at 50° F.; and this character, therefore, becomes a test of the purity of the oil. Its boiling point is 412°.[2] Its taste is sweetish, pungent, and peculiar; its odour characteristic and agreeable. It solidifies when dropped into a solution of potash or soda. The aqueous solution of the oil assumes, on the addition of a persalt of iron, a violet colour (*salicylate of the peroxide of iron*). The commercial oil consists, according to Cahours,[3] of two volatile oils,—one light, the other heavy. The *light oil of partridge-berry*, or *gaultherylene* ($C^{20}H^{16}$), constitutes about $\frac{1}{10}$th part of the commercial oil, and forms the first portion which distils over. It is a colourless, very limpid oil, with an agreeable odour, approximating to that of oil of pepper. It boils at 417° F. It is isomeric with oil of turpentine. The *heavy oil of partridge-berry*, *gaultheric acid*, or *salicylate of methylene* ($C^{2}H^{3}O,C^{14}H^{5}O^{5}$), constitutes $\frac{9}{10}$ths of the commercial oil. It is a colourless liquid, having a sp. gr. of 1·18 at 50° F., and a warm and aromatic taste. It dissolves in all proportions in alcohol and ether, and slightly so in water. It combines with bases to form salts (*gualtherates*).

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[1] Rafinesque observes that this plant was dedicated to Dr. Gautier, of Canada, by Kalm, wrongly misspelt *Gaultheria* and *Gualtheria*; and that it is a creeping not procumbent: hence he proposed to change the name from Gaultheria procumbens to Gautiera repens.

[2] Mr. Procter, Jun., *Am. Journ. of Pharm.* iii. and xiv.

[3] *Ann. de Chim. et Phys.* 3me sér. t. x. p. 327.

The commercial oil of partridge-berry is an aromatic stimulant, and is chiefly used to cover the unpleasant flavour of other medicines (see *Syrup of Sarsaparilla*, p. 1175). Like other essential oils, it is sometimes employed to allay toothache. In the dose of a fluid-ounce it has caused death: on examination of the body, strong marks of inflammation of the stomach were discovered.[1] The *essence*, prepared by dissolving the oil in rectified spirit, is sometimes employed as a cordial and stimulant.

ORDER LIII. LOBELIACEÆ, *Jussieu.*—LOBELIADS.

CHARACTERS.—*Calyx* 5-lobed, more or less adherent to the ovary. *Corolla* persistent, more or less gamopetalous; *lobes* or petals 5, usually irregular, sometimes almost regular; *tubes* entire or cleft longitudinally. *Æstivation* somewhat valvular. *Stamens* 5, alternate with the lobes of the corolla, usually free, but sometimes adherent to the tube of the corolla; *filaments* free, or more or less connate; *anthers* cohering, bilocular, dehiscing longitudinally; *pollen* ovoid. *Ovary* inferior or semi-superior, 2- or rarely 1-celled, then with parietal placentæ; *style* 1; *stigma* surrounded with a ring of hairs. *Fruit* usually dehiscing at the apex by 2 valves, rarely from above by an operculum, or laterally by 3 valves, or indehiscent. *Seeds* indefinite; *albumen* fleshy; *embryo* straight.—Lactescent *herbs* or *under-shrubs*, rarely small *trees*. *Leaves* alternate, without stipules. *Flowers* usually axillary, solitary, racemose. (Condensed from De Cand.)

PROPERTIES.—Dangerous or suspicious plants; mostly acrids or acro-narcotics.

217. LOBELIA INFLATA, *Linn.*—BLADDER-PODDED LOBELIA; INDIAN TOBACCO.

Sex. Syst. Pentandria, Monogynia.

(Herba florens, *L.*—Herb, *E. D.*)

HISTORY.—This plant was employed by the aborigines in America; and after having been for some time used by quacks, was introduced to the notice of the profession by the Rev. Dr. Cutler, of Massachusetts.[2] It was introduced into England, in 1829, by Dr. Reece.[3]

BOTANY.—**Gen. Char.**—*Calyx* 5-lobed; the tube obconical, ovoid or hemispherical. *Corolla* cleft longitudinally from above, bilabiate; the *tube* cylindrical or funnel-shaped, straight; the *upper lip* usually smaller, and erect; the *lower* generally spreading, broader, 3-cleft, or more rarely 3-toothed. The 2 inferior, or occasionally all of the *anthers*, barbed at the point. *Ovary* inferior or semi-superior, and (in species very much alike) somewhat free (*De Cand.*)

Sp. Char.—*Stem* erect, the lower part simple and shaggy; the upper part ramose and smooth. *Leaves* irregularly serrate-dentate, hairy; the lower ones oblong, obtuse, shortly petioled; the middle ones ovate-acute, sessile. *Flowers* small, racemose. *Pedicels* short, with an acuminate bract. *Calyx* smooth, the *tube* ovoid; the lobes linear-acuminate, equal to the corolla. *Capsule* ovoid, inflated (*De Cand.*)

Annual; height, a foot or more. *Root* fibrous. *Stem* angular. *Leaves* scattered; segments of the *calyx* linear, pointed. *Corolla* delicate

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[1] *United States Dispensatory* (*Journ. of Phil. Col. of Pharm.* vi. 290).

[2] Thacker's *Amer. New Dispensatory*, 2d ed. p. 258.

[3] *Pract. Treat. on the Anti-asthmatic Properties of Bladder-podded Lobelia.*

Procter's Analysis.	*Pereira's Analysis.*	*Reinsch's Analysis.*	
A peculiar acrid alkaline principle.	Volatile principle.	Water	11·
Resin.	Lobelina.	Volatile oil	not determined
Chlorophylle.	Lobelic acid.	Alcoholic extract —	
Gum.	Resin.	Chlorophylle	5·
Gallic [lobelic] acid.	Chlorophyile.	Wax	
Fixed oil.	Gum.	Resin	
Salts of lime.	Extractive.	Stearine	
Salts of potash.	Caoutchouc ?	Peculiar substance (*Lobeliin*)	2·
Oxide of iron.	Woody fibre.	Aromatic resin	1·
Lignin.		Vegetable gluten	2·
		Aqueous extract —	
		Gum	6·
		Potash, lime, magnesia, iron and manganese salts, with organic and inorganic acids	2·
		Extracted by potash —	
		Gum	42·
		Vegetable fibre	26·
			100·

1. **VOLATILE OIL OF LOBELIA**; *Odorous Principle of Lobelia ; Lobelianin.* — Wate distilled from lobelia has the peculiar smell, and in my former experiments appeared t me to possess also the nauseous, acrid taste, of the plant ; but Mr. Procter, Jun. declare it to be devoid of acrimony, and Reinsch states that the oil which comes over on th water has a bland taste and a moderately strong odour. In one experiment I obtaine a thin film of what appeared to be a solid volatile oil. The distilled water of lobelia i unaffected by acids, sesquichloride of iron, and tincture of nutgalls.

2. **LOBELINA**; *Lobeliin; Peculiar Acrid Alkaline Principle.*— The existence of thi principle was first announced, though not isolated, by Dr. Colhoun. According t Mr. Procter, it is found in the seeds in larger proportion than in the herb. From twelv ounces of the former he obtained eighteen and a half grains of lobelina. He procure it by treating the seeds with alcohol acidulated with acetic acid until deprived of thei acrimony. The tincture was evaporated to the consistence of an extract which wa triturated with magnesia and water, and after repeated agitation with water, the liquo which held lobelina in solution was filtered and shaken repeatedly with ether unt deprived of acrimony ; the ethereal solution was then decanted and allowed to evaporat spontaneously. The impure lobelina thus obtained was dissolved in water by the aid sulphuric acid, the solution decolorised by animal charcoal, and then mixed with mag nesia. The liquor was then agitated with ether to dissolve the lobelina which had bee set free, and the ethereal solution allowed to evaporate spontaneously.

Mr. Bastick's process for obtaining it is similar to that recommended by Liebig fo procuring hyoscyamia.

Lobelina is a liquid alkaloid, of a light yellow colour and somewhat aromatic odou It is lighter than water, on which fluid it floats. It is soluble in water, but more so i alcohol and ether. It is also soluble in oil of turpentine and oil of sweet almonds. has an alkaline reaction on reddened litmus paper, and unites with sulphuric, nitri hydrochloric, oxalic, and lobelic acids, to form crystallisable salts, which are more solubl in water than the alkaloid itself. Tannic acid throws it down from its solution in th form of a white bitannate. Mr. Bastick says lobelina is volatile, but does not evapora entirely unchanged. Lobelina is the active principle of the plant, but is not so acti as nicotine. A quarter of a grain excited vomiting and much prostration in a cat. grain caused immediate and total prostration, which for half an hour rendered th animal almost motionless, and caused dilatation of the pupils.

3. **LOBELIC ACID.**— In 1842 I drew attention to the peculiarity of this acid, to whic I gave the name it now bears ; and Mr. W. Procter, Jun. has subsequently confirme my statements. It had previously been confounded with gallic acid. With the persal of iron a solution of lobelic acid causes an olive-brown precipitate,[1] with sulphate copper a pale green, with nitrate of silver a brownish precipitate soluble in nitric aci

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[1] The effect produced by persalts of iron on this acid is analogous to that caused by t same agents on aloes (see *ante*, Vol. II. Pt. 1. p. 194) and cebadilla (see *ante*, Vol. II. Pt. 1. p. 17

said to be produced by it in cattle.[1] Hedgehogs and cats are killed b it.[2]

β. *On Man.*—αα. *In small doses* it operates as a *diaphoretic and expectorant.* Mr. Andrews,[3] who speaks from its effects on himself, says i has "the peculiar soothing quality of exciting expectoration without th pain of coughing."

ββ. *In full medicinal doses* (as ℈j. of the powder) it acts as a powerfu nauseating *emetic.* Hence it has been called the *emetic weed.* It cause severe and speedy vomiting, attended with continued and distressin nausea, sometimes purging, copious sweating, and great general relaxation. These symptoms are usually preceded by giddiness, headache and general tremors. The Rev. Dr. M. Cutler,[4] in his account of th effects on himself, says that, taken during a severe paroxysm of asthma it caused sickness and vomiting, and a kind of pricking sensation throug the whole system, even to the extremities of the fingers and toes. Th urinary passage was perceptibly affected, by producing a smarting sensation in passing urine, which was probably provoked by stimulus on th bladder. It sometimes, as in the Rev. Dr. Cutler's case, gives almos instantaneous relief in an attack of spasmodic asthma. Intermitten pulse was caused by it in a case mentioned by Dr. Elliotson. Administered by the rectum, it produces the same distressing sickness of stomach profuse perspiration, and universal relaxation, which result from a similar use of tobacco.

γγ. *In excessive doses, or in full doses too frequently repeated,* its effect are those of a powerful *acro-narcotic poison.* "The melancholy consequences resulting from the use of Lobelia inflata," says Dr. Thacher, "as lately administered by the adventurous hands of a noted empiric, have justly excited considerable interest, and furnished alarming example of its deleterious properties and fatal effects. The dose in which he i said usually to prescribe it, and frequently with impunity, is a commo tea-spoonful of the powdered seeds or leaves, and often repeated. If th medicine does not puke or evacuate powerfully, it frequently destroy the patient, and sometimes in five or six hours." Its effects, accordin to Dr. Wood,[7] are "extreme prostration, great anxiety and distress, an ultimately death, preceded by convulsions." He also tells us that fata results (in America) have been experienced from its empirical use These are the more apt to occur when the poison, as is sometimes th case, is not rejected by vomiting.

Within the last three years several cases[8] of poisoning by lobelia hav by digestion, *E.*)—Dose, as an emetic and antispasmodic, from fʒj. t fʒij., repeated every two or three hours until vomiting occur; as an expectorant, ♏x. to fʒj. For children of one or two years old, the dos is ♏x. to ♏xx.

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[1] *Lancet,* May 13, 1837, p. 299.

[2] See the experiments of Mr. Curtis and Dr. Pearson in the *Lond. Med. Gaz.* Aug. 1 1850.

[3] *Lond. Medical Gazette,* vol. iii. p. 260.

[4] Thacher, *op. cit.*

[5] *Op. cit.*

[6] The empiric alluded to by Dr. Thacher is Samuel Thomson, the author of a wor entitled "*The Thomsonian Materia Medica, or Botanic Family Physician,*" 12th ed. 8v Albany, 1841.

[7] *United States Dispensatory.*

[8] See *Lond. Medical Gazette* for Aug. 31, 1849, and Aug. 30, 1850; also, *Lancet* for Sep 8, 1849, and June 22, 1850; and *Pharmaceutical Journal* for Aug. 1851.

2. **TINCTURA LOBELIÆ ÆTHEREA**, L. E.; *Ethereal Tincture of Lobelia* (Lobelia, in powder, ℥v.; Æther, f℥xiv.; Rectified Spirit, f℥xxvj Macerate for seven days; then express and strain, *L.*—Lobelia, dried and in moderately fine powder, ℥v.; Spirit of Sulphuric Ether, Oij This tincture is best prepared by percolation, as directed for tincture o capsicum; but it may also be obtained by digestion in a well-closed vesse for seven days, *E.*)—This may be used in the same doses as the alcoholi tincture.

With some persons the ether is apt to disagree, and for such the alcoholi tincture is preferred. *Whitlaw's ethereal tincture,* used by Dr. Elliotson consisted of Lobelia, lbj.; Rectified Spirit, Oiv.; Spirit of Nitric Ether Oiv.; Spirit of Sulphuric Ether, ℥iv. Macerate for fourteen days in dark place.[1]

218. Lobelia syphilitica, *Linn.*—Blue Cardinal.

(Radix.)

This plant is a native of the United States of America. It possesses emetic, catharti and diuretic properties; and derived its specific name from its supposed efficacy i syphilis, as experienced by the North American Indians, who considered it a specifi in that disease, and from whom the secret of its use was purchased by Sir W. Johnson Its antisyphilitic powers appear to have no foundation in fact.[3] The root was the pa used; it was given in the form of decoction, prepared by boiling half an ounce of th root in twelve pints of water down to one-third. The dose is a wine-glassful.

Order LIV. COMPOSITÆ, *De Candolle.*—COMPOSITES.

Synanthereæ, *Richard;* Asteraceæ, *Lindley.*

Characters.—*Calyx* gamosepalous, the tube adherent to the ovary; the *limb* gen rally degenerated into a pappus, or sometimes into a scaly corona, or entirely abortiv *Pappus* simple, pilose, ramose, or plumose; stipitate by the prolongation of the tu beyond the ovary, or sessile. *Corolla* inserted into the upper part of the tube of t calyx, gamopetalous; the nerves in the tube being directed towards the sinuses; appearance 5, but really 10; which then proceed from the sinuses, along the margi of the lobes, to the apex, where they inosculate [*neuramphipetalous*]. *Tube* vario in length; in the regular corolla, often funnel-shaped. *Lobes* generally 5, valvate æstivation. *Corolla* regular or irregular; the regular, of 5 equal lobes (*tubular corolla* the irregular 2-lipped (*bilabiate corolla*) or strap-shaped, 5-dentate (*ligulate corolla* *Stamens* generally 5; in the female florets wanting, or rudimentary. *Filaments* adna to the tube of the corolla; distinct or monadelphous; articulated near the apex, t upper portion acting as a connective. *Anthers* erect; connected in the tube, which perforated by the style (*syngenesious* or *synantherous*). *Pollen* rough or smooth, globo or elliptical. *Ovary* adherent to the calyx, 1-seeded. *Style* generally terete and bif at the apex; the branches (commonly called *stigmas*) more or less free; flat abov convex beneath. *Stigmatic glands* (*true stigmas*) ranged in a double row along t grows in Columbia on the banks of the Magdalena. Guaco has also been used in cholera Several plants have been brought to Europe under the name of guaco.[2] Fouré[3] an lysed one of these, and announced the existence in it of a peculiar resin, to which h gave the name of *guacine*. There can be no doubt that if guaco really possesses an therapeutical value whatever, its virtues have been monstrously exaggerated.

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[1] *Lancet*, June 3, 1837.

[2] Woodville, *Med. Bot.* vol. i. p. 178: see also Murray's *App. Medicaminum*, vol. i. p. 77 ed. alt. 1793.

[3] Pearson, *Observ. on various Art. of the Mat. Med.* p. 70.

219. Tussilago Farfara, *Linn.*—Coltsfoot.

Sex. Syst. Syngenesia, Polygamia superflua.

(Folia et Flores.)

Βήχιον of Hippocrates (*de intern. affect.* p. 532; et *de articulis*, p. 829, ed. Fœs.) an Dioscorides (lib. iii. cap. 126). By the Greeks and Romans it was smoked, to relie obstinate cough (see *ante*, p. 567).

Rhizome creeping horizontally. Leaves cordate, angular, toothed, downy beneat Scape clothed with imbricated scaly bracts, usually 1-flowered. Heads appearin before the leaves. Flowers yellow. Indigenous. Various parts of Europe and Asi Flowers in March and April. The herb and flowers (*herba et flores farfaræ* seu *tu silaginis*) have a bitterish mucilaginous taste. The dried leaves are odourless, but t flowers retain a slight odour. The watery infusion becomes green (*tannate of iron*) the addition of sesquichloride of iron. No analysis of the plant has yet been mad *Mucilage*, *bitter extractive*, *tannic acid*, *colouring matter*, *salts*, and *woody fibre*, are t principal constituents. The effects are not very obvious: they may be regarded emollient, demulcent, and very slightly tonic. Employed as a popular remedy in pu monary complaints (chronic coughs especially). The *decoction* (prepared by boilin ℥j. or ℥ij. of the plant in Oij. of water to Oj.) may be taken in doses of f℥ij. or f℥ii or ad libitum.

Tribe III. Asteroideæ.

Style cylindrical; its arms linear, flattish on the outside, equally and finally downy on the inside.

220. INULA HELENIUM, *Linn.*—ELECAMPANE.

Sex. Syst. Syngenesia, Polygamia superflua.

(Radix, *L.*)

History.—This is the ἐλένιον of Hippocrates[4] and of Dioscorides.[5]

Botany. **Gen Char.**—*Head* many-flowered, heterogamous; *florets* the ray females, in one row, sometimes by abortion sterile, usually ligulat rarely somewhat tubular and trifid; those of the disc hermaphrodite, t bular, 5-toothed. *Involucre* imbricated in several rows. *Receptacle* fl or somewhat convex, naked, *Anthers* with 2 setæ at the base. *Ache* without a beak, tapering, or, in *I. Helenium*, 4-cornered. *Pappus* uniforn in 1 row, composed of capillary, roughish setæ (*De Cand.*)

Sp. Char.—*Stem* erect. *Leaves* dentate, velvety-tomentose beneat acute; the radical ones ovate, greatly attenuated into petioles; those the stem semi-amplexicaul. *Peduncles* few, 1-headed, corymbose at t apex (*De Cand.*)

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[1] Dunglison, *New Remedies*, p. 403, 6th ed. 1851.

[2] Dierbach, *Die neuesten Entdeck. in der Mat. Med.* Bd. i. S. 164, 1837; and Bd. ii. S. 2

[3] *Journ. de Pharm.* t. xxii. p. 291, 1836.

[4] *Nat. Mul.* p. 572, ed. Fœs.

[5] Lib. i. cap. 27.

Root perennial, thick, branching. *Stem* 3 to 5 feet high. *Leaves* large, serrated, veiny. *Heads* terminal. *Flowers* bright-yellow.

HAB.—Indigenous. Various parts of Europe. Flowers in July and August.

DESCRIPTION.—The dried root (*radix helenii* seu *enulæ*) of the shops consists of longitudinal or transverse slices, which are yellowish-grey, and have an aromatic or camphoraceous smell, and a warm bitter taste. Iodine colours the root brown. Sesquichloride of iron produces in the infusion a green colour (*tannate of iron*).

COMPOSITION.—The root has been analysed by John,[1] by Funcke,[2] and by Schulz.[3] The constituents, according to John, are—*volatile oil* a trace, *elecampane-camphor* 0·3 to 0·4, *wax* 0·6, *acrid soft resin* 1·7, *bitter extractive* 36·7, *gum* 4·5, *inulin* 36·7, *woody fibre*, 5·5, *oxidised extractive with coagulated albumen* 13·9; besides *salts of potash, lime, and magnesia.*

1. HELENIN; *Elecampane-camphor.*—Colourless prismatic crystals, heavier than water, fusible, volatile, very soluble in ether, oil of turpentine, and boiling alcohol, but insoluble in water. Nitric acid converts it into resin (*nitrohelenin*). Its formula, according to Dumas, is $C^{14}H^{9}O^{2}$; according to Gerhardt,[4] $C^{15}H^{10}O^{2}$. Its composition, therefore, is closely allied to that of creosote.

2. RESIN.—Brown, fusible in boiling water, and soluble in alcohol and ether. When warm it has an aromatic odour. Its taste is bitter, nauseous, and acrid.

3. INULIN (*Alantin* and *Menyanthin*, Trommsdorff; *Elecampin*, Henry; *Dahlin* and *Datiscin*, Payen).—An amylaceous substance, organised, according to Raspail, like common starch. It is very slightly soluble in cold water, but very soluble in boiling water, from which it is deposited as the solution cools. It is slightly soluble in boiling alcohol. Iodine gives it a yellow tint: this distinguishes it from ordinary starch. Its formula is $C^{12}H^{10}O^{10}$. In combination with lead it produces an atom of water, and becomes $C^{12}H^{9}O^{9}$.

4. BITTER EXTRACTIVE.—In this resides the tonic property of elecampane.

PHYSIOLOGICAL EFFECTS.—An aromatic tonic. It acts as a gentle stimulant to the organs of secretion, and is termed diaphoretic, diuretic, and expectorant. Large doses cause nausea and vomiting. It was formerly supposed to possess emmenagogue properties. In its operation it is allied to sweet-flag and senega.

USES.—It is rarely employed now by the medical practitioner. It has been used in pulmonary affections (as catarrh) attended with profuse secretion and accumulation of mucus, but without febrile disorder or heat of skin. In dyspepsia, attended with relaxation and debility, it has been administered with benefit. It has also been employed in the exanthemata to promote the eruption.

ADMINISTRATION.—Dose of the *powder*, ℈j. to ʒij.; of the *decoction* (prepared by boiling ℥ss. of the root in Oj. of water), f℥j. to f℥ij.

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[1] Gmelin, *Handb. d. Chem.* ii. 1288.

[2] *Trommsdorff's Journal*, xviii. 1, 74.

[3] *Berl. Jahrb. d. Pharm.* 1818, p. 251.

[4] *Pharmaceutisches Central-Blatt für* 1840, p. 309.

TRIBE IV. SENECIONIDEÆ.

Style cylindrical; its arms linear, fringed at the point, generally truncate, but som times extended beyond the fringe into a line or appendage of some sort.

221. ANTHEMIS NOBILIS, *Linn.*—COMMON CHAMOMIL

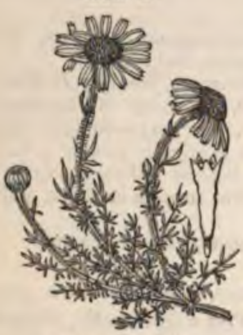
Sex. Syst. Syngenesia, Polygamia superflua.

(Flores simplices, *L.*—Flowers, *E.* —Flores, *D.*)

HISTORY.—Sibthorp[1] considers the ἀνθεμίς of Dioscorides [2] to be *A themis Chia;* but Fraas[3] is of opinion that it is the *Matricaria Chamomil* Linn. Tragus considered the Anthemis nobilis to be the παρθένιον Dioscorides, and first gave it the name of *Chamomilla nobilis.* Camerari distinguished it as the *Roman chamomile.*

BOTANY. **Gen. Char.**—*Head* many-flowered, heterogamous; *florets* the ray female, in one row, ligulate (rare none, or somewhat tubular); of the disc, he maphrodite, tubular, 5-toothed. *Recepta* convex, oblong, or conical; covered wi membranous paleæ between the flowers. *I volucre* imbricated, in a few rows. Arms the *style* without appendages at the ape *Achene* tapering or obtusely 4-corner striated or smooth. *Pappus* either wantir or a very short, entire, or halved membran sometimes auriculate at the inside (*De Can*

FIG. 4.



Anthemis nobilis.

Chamomile.

Sp. Char.—*Stem* erect, simple, ramo downy-villose. *Leaves* downy, sessile, pin tisect; segments split into many line setaceous lobes. *Branches* flowery, nak 1-headed at the apex. Scales of the *involu* obtuse, hyaline at the margin. Paleæ of the *receptacle* lanceolate, poi less, somewhat shorter than the floret, slightly eroded at the margin (*Cand.*)

Roots shiny, with long fibres. *Stems* in a wild state prostrate, gardens more upright, a span long, hollow, round. *Flowers* of the d yellow; of the ray, white. *Receptacle* convex.

Anthemis nobilis flore pleno, De Cand.; *Double Chamomile.*—In this variety, yellow tubular hermaphrodite florets of the disc are entirely or partially converted i white ligulate female florets.

Sir J. Smith[4] speaks of the *discoid variety,* destitute of rays, as being more rare. ought perhaps, he adds, to be preferred for medicinal use.

Hab.—Indigenous; on open gravelly pastures or commons. Perenn lowers from June to September. Cultivated at Mitcham and in Derbyhire, for the London market.[1]

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[1] *Prodr. Fl. Græcæ,* vol. ii. p. 189.

[2] Lib. iii. cap. 154.

[3] *Synopsis Plant. Fl. Classicæ,* p. 214, 1845.

[4] *Eng. Fl.* vol. iii. p. 457.

DESCRIPTION.—The floral heads (*flores chamæmeli romani* seu *anthemiis nobilis*) have a strong and peculiar odour, and a bitter aromatic taste. Vhen fresh, they exhibit a strong and peculiar fragrancy when rubbed. hey should be dried in the shade.

Two kinds of chamomiles are distinguished in the shops,—the one alled *single*, the other *double*: both sorts are cultivated at Mitcham.

1. *Single Chamomile Flowers* (*flores anthemidis simplices*).— These re sold at Apothecaries' Hall, London. Strictly speaking, *single* hamomiles are those which have one row only of white female ligulate orets: but few flowers are in this condition; in most of the so-called ingle flowers some of the yellow tubular florets have become converted nto white ligulate florets. It is obvious, therefore, that the distinction etween the so-called single and double flowers is to a certain extent rbitrary. Single chamomiles are usually preferred, on account of their aving the largest yellow discs, in which the oil chiefly resides. They re, therefore, more powerfully odoriferous.

2. *Double Chamomile Flowers* (*flores anthemidis pleni; chamæmelum lore pleno*, Lewis; *chamæmelum flore multiplici*, C. Bauhin).—These onstitute the sort usually found in the shops. In these, all or most of he yellow tubular florets have become converted into the white ligulate nes. The flowers are consequently whiter, larger, and more showy, hough rather less odoriferous, and contain less volatile oil.

At Mitcham a variety, called the *new sort*, of chamomile is cultivated, which yields y distillation a blue volatile oil.

The *Flores Chamomillæ* of German pharmacologists are the produce of *Matricaria hamomilla*, Linn., or *Common Wild Chamomile*. They yield by distillation a blue olatile oil.

The *Flores Chamomillæ fœtidæ* are the produce of *Maruta Cotula*, De Cand. (*Anemis Cotula*, Linn.)

COMPOSITION.—In 1833, chamomile flowers were analysed by J. P. Wys,[2] who gives the following as their constituents:—*Fat, chlorophylle*, races of *tannic acid*, and *volatile oil* 3·625, *wax* 1·5, *bitter matter* extracted y ether, with traces of *malate of lime* 4·000, *resin* 5·250, *extractive matter* aken up by alcohol, and *malate of lime* 3·125, *albumen* 1·500, *sulphate nd tartrate of potash* with *chloride of potassium and malate of lime* 1·875, um 0·750, *extractive matter* taken up by water 5·500, *extractive matter* ith *phosphate of lime* taken up by hydrochloric acid 7·750, *water* and oss 3·125, *fibrous matter* and loss 62·000 = 100·000.

1. VOLATILE OIL (see p. 20).

2. BITTER EXTRACTIVE.—The bitter principle of chamomiles is soluble in both ater and alcohol.

3. TANNIC ACID.—The cold watery infusion of the flowers is darkened by sesquihloride of iron, and forms a precipitate with gelatine.

Freudenthal[3] analysed the dried flowers of the *Common Wild Chamomile* (*Matriaria Chamomilla*), and found them to consist of *volatile oil* 0·28, *resin* 7·89, *bitter exractive* 8·27, *gum* 7·39, *bitartrate of potash* 5·31, *phosphate of lime* 0·97, *woody fibre*,

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[1] *Pharmaceutical Journal*, vol. x. p. 116, 1850.

[2] Buchner's *Repertorium*, Bd. xlvi. S. 18, 1833.

[3] Gmelin, *Handb. d. Chem.* ii. 1292.

soluble albumen, water, and loss 69·6. These flowers were also analysed by Herberger and Damur.[1]

PHYSIOLOGICAL EFFECTS. — Chamomiles produce the effects of the *aromatic bitter tonics* before alluded to: their aromatic qualities depend on the volatile oil, their stomachic and tonic qualities on bitter extractive and tannic acid. In large doses they act as an emetic.

USES.—Chamomiles are an exceedingly useful stomachic and tonic in *dyspepsia,* with a languid and enfeebled state of stomach, and general debility. As a remedy for *intermittents,* though they have gained considerable celebrity, they are inferior to many other medicines. The oil is sometimes used to relieve *flatulency, griping,* and *eructation;* and the warm infusion is employed as an *emetic.*

ADMINISTRATION.—The *powder* is rarely employed, on account of the inconvenient bulk of the requisite quantity, and its tendency to excite nausea.—Dose, grs. x. to ʒss. or more. The *infusion* is the more elegant preparation: this, as well as the *extract* and *oil,* are officinal. *Fomentations of Chamomile flowers* consist of the infusion or decoction, and are used quite hot; but they present no advantage over water of the same temperature. *Flannel bags filled with chamomiles and soaked in hot water* are useful topical agents for the application of moist warmth, on account of their retention of heat.

1. **INFUSUM ANTHEMIDIS**, L. E. D.; *Infusum Chamæmeli; Infusion of Chamomile; Chamomile Tea.* (Chamomile, ʒv.; Boiling [distilled *L.*] Water, Oj. *L. E.*—Chamomile Flowers, dried, ℥ss.; Boiling Water, ℥xij. *D.*—Macerate for ten [twenty, *E.*, fifteen, *D.*] minutes in a covered vessel and strain.)—It is taken warm to excite gentle vomiting or to promote the operation of an emetic. The cold infusion is usefully employed as a domestic stomachic bitter and tonic in dyspepsia.—Dose of the cold infusion, f℥j. to f℥ij.; of the warm infusion, *ad libitum.*

2. **EXTRACTUM ANTHEMIDIS.** E.; *Extractum Chamæmeli; Extract of Chamomile.* (Chamomile, lb. j.: boil it with a gallon of water down to four pints; filter the liquid hot; evaporate in the vapour-bath to a du consistence, *E.*)—One hundredweight of the flowers yields about forty eight pounds of extract. The volatile oil is dissipated during the preparation. The extract is a bitter stomachic and tonic. It is generally used as a vehicle for the exhibition of other tonics, in the form of pills Conjoined with the oil of chamomile, we can obtain from it all the effect of the recent flowers.—Dose, grs. x. to ℈j.

3. **OLEUM ANTHEMIDIS**, L. E. D.; *Oleum Chamæmeli Romani; Oleum Chamæmeli; Oil of Chamomile; Oil of the Roman Chamomile.* (Obtaine by submitting the flowers to distillation with water.)—One hundred weight of flowers yields from ℥iss. to ℥ij. of oil. The oil of the shops i frequently brought from abroad, and is probably the produce of anothe plant (*Matricaria Chamomilla*): hence the London College directs th English oil (*oleum anthemidis anglicum*) to be kept. The oil of chamomil which, when first drawn, is pale blue, becomes, by exposure to light an

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[1] Buchner's *Repertorium,* Bd. xliv. S. 361, 1833.

air, yellow or brownish. Lewis[1] says that the yellow oil, with a cast of greenish or brown, has a sp. gr. of 0·9083. When fresh, its odour is strong and peculiar, and its taste pungent and nauseous. It is stimulant and antispasmodic. It is a frequent addition to tonic and cathartic pills; it communicates stimulant qualities to the former, and is believed to check the griping caused by the latter. It is occasionally exhibited in the form of elæosaccharum.—Dose, ♏j. to ♏v.

222. ANACYCLUS PYRETHRUM, *De Cand.*—PELLITORY OF SPAIN.

Anthemis Pyrethrum, *Linn.*

(Radix, *L.*—Root, *E.*)

HISTORY.—Dioscorides[2] was acquainted with πύρεθρον, and speaks of its use in toothache. The word *pyrethrum* is mentioned once only by Pliny.[3]

BOTANY. **Gen. Char.**—*Head* many-flowered, heterogamous. *Florets* of the ray female, sterile, ligulate or somewhat so, very rarely tubular; of the disc hermaphrodite, with 5 callous teeth. *Receptacle* conical or convex, paleaceous. *Involucre* in few rows, somewhat campanulate, shorter than the disc. All the *corollas* with an obcompressed, 2-winged, exappendiculate tube. *Style* of the disc, with exappendiculate branches. *Achene* flat, obcompressed, bordered with broad, entire wings. *Pappus* short, irregular, tooth-letted, somewhat continuous with the wings on the inner side (De Cand.)

Sp. Char.—*Stems* several, procumbent, somewhat branched, pubescent. Radical *leaves* expanded, petiolated, smoothest, pinnatisect; the segments pinnatipartite, with linear subulate lobes; the cauline leaves sessile. *Branches* 1-headed. *Involucral* scales lanceolate, acuminate, brown at the margin. *Receptacle* convex, with oblong-obovate, obtuse paleæ (De Cand.)

Root fusiform, fleshy, very pungent, and, when fresh, producing a sensation of extreme cold, followed by heat when handled. *Florets* of the ray white on the upper side, purplish beneath; of the disc, yellow.

Hab.—Barbary, Arabia, Syria, and perhaps Candia.

DESCRIPTION.—The root (*radix pyrethri; r. pyrethri romani veri*) is imported from the Levant packed in bales. It consists of inodorous pieces, about the length and thickness of the little finger, covered with a thick brown bark, studded with black shining points, breaking with a resinous fracture, and presenting internally a radiated structure. When chewed, it excites a pricking sensation in the lips and tongue, and a glowing heat.

German pellitory root (*radix pyrethri communis* seu *germanici*) is in much thinner, somewhat longer pieces, crowned superiorly with the bases of the stalks and petioles.

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[1] *Mat. Med.*

[2] Lib. iii. cap. 86.

[3] *Hist. Nat.* lib. xxviii. cap. 42, ed. Valp.

It is the produce of *Anacyclus officinarum* of Hayne[1], which Nees[2] regards as a variet of *A. Pyrethrum* of Schrader. De Candolle[3] considers it to be identical with *A. pulche* of Besser.

COMPOSITION.—It was analysed by John,[4] by Gautier,[5] by Parisel, and lastly by Koene.[7] Parisel obtained *acrid matter* (*pyrethrin*) 3, *inuli* 25, *gum* 11, *tannin* 0·55, *colouring matter* 12, *lignin* 45, *chloride of potas sium* 0·79, *silica* 0·85, and *iron* a trace.

PYRETHRIN; *Acrid Principle; Resin.*—In this resides the activity of the root. I exists in greater abundance in the bark than in the wood. It is brown, soft, has burning acrid taste, is insoluble in water, but soluble in ether and alcohol; still more s in acetic acid and the oils (volatile and fixed). Koene says, pyrethrin consists of thre substances:—

α. *A brown acrid resin*, soluble in alcohol, insoluble in water or caustic potash.
β. *An acrid brown fixed oil*, soluble in potash.
γ. *A yellow acrid oil*, soluble in potash.

PHYSIOLOGICAL EFFECTS.—Pellitory is an energetic local irritant Applied to the skin, it acts as a rubefacient.

USES.—Scarcely ever employed internally. Its principal use is t yield a tincture for the relief of toothache. As a masticatory and sia logogue, it is chewed in some rheumatic and neuralgic affections of th head and face, and in palsy of the tongue. In relaxation of the uvula i is occasionally employed in the form of gargle. It was formerly employe internally as a gastric stimulant.

ADMINISTRATION.—Dose, as a *masticatory*, ʒss. to ʒj. *Tinctura py rethri* (composed of Pyrethrum, Water, of each, one part; Rectified Spiri five parts) is used to relieve toothache.

223. ARTEMISIA ABSINTHIUM, *Linn.*—COMMON WORM WOOD.

Sex. Syst. Syngenesia, Polygamia superflua.

(Herba florens, *L.*—Herb, *E.*)

HISTORY.—In all probability this plant is the ἀψίνθιον of Hippocrates and Dioscorides.[9] The term *wormwood* occurs several times in our trans lation of the Old Testament;[10] but the plant meant would appear t be both bitter and poisonous.

BOTANY. **Gen. Char.**—*Heads* discoidal, homogamous or heterogamou *Florets* of the ray in one row, usually female and 3-toothed, with a lon bifid protruding style; of the disc, 5-toothed, hermaphrodite, or, by th absorption of the ovary, sterile or male. *Involucral* scales imbricate

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[1] *Darst. u. Beschr. d. in d. Arzneykunde gebr. Gewachse*, Bd. vi. Tab. 46.
[2] Geiger's *Pharmacie*, 2te Aufl. 1839.
[3] *Prodromus*, t. vi. p. 16.
[4] Gmelin, *Handb. d. Chem.* ii. 1292.
[5] *Journ. de Pharm.* iv. 49.
[6] *Ibid.* xix. 251.
[7] *Ann. d. Chim. Phys.* lix. 327.
[8] *Opera*, pp. 491, 587, &c., ed. Fœs.
[9] Lib. iii. cap. 26.
[10] *Deut.* xxix. 18; *Prov.* v. 4.

arious at the edge. *Receptacle* without paleæ, flattish or convex,
or fringed with hairs. *Achene* obovate, bald, with a minute epigy-
isc (De Cand.)

har.—An erect *undershrub*. *Leaves* silky, hoary, tripinnatisect;
gments lanceolate, somewhat dentate, obtuse. The *heads* small,
se-paniculate, globose, nodding. Exterior scales of the *involucre*
hat silky, linear, lax; interior ones rounded, scarious, somewhat
(De Cand.)

b covered with silky hoariness, intensely bitter, with a strong
ar odour. *Stems* numerous, about a foot high. *Leaves* rather
r on the upper side; lower ones on long footstalks; upper on
r, broader, somewhat winged ones. *Florets* pale yellow, or buff.

.—Indigenous; in waste grounds. Perennial. Flowers in
st.

SCRIPTION.—The dried herb with the flowers, or the tops (*herba
ummitates absinthii*), have a whitish-grey appearance, a soft feel, a
aromatic and somewhat unpleasant odour, and an extremely
aromatic taste. The cold watery infusion becomes greyish,
green, and turbid (*tannate of iron*) on the addition of sesquichloride
n.

MPOSITION.—This plant has been analysed by Kunsemuller,[1] by
nnot,[2] and by Haynes.[3] The extract was examined by Leonardi.[4]
nnot found *volatile oil* 0·15; *green resin* 0·50, *bitter resin* 0·233, *al-*
1·250, starch 0·133, *azotised matter* having little taste 1·333, *bitter*
d matter 3·0, *woody fibre* 10·833, *absinthate of potash* 0·917,
of potash 0·333, *sulphate of potash and chloride of potassium*, traces,
81·2.

OLATILE OIL (*Oleum Absinthii*).—Green, sometimes yellow or brownish oil,
a strong odour of wormwood, and an acrid, bitter, peculiar taste. Its sp. gr. is
Nitric acid colours it green, then blue, afterwards brown.

ITTER PRINCIPLE (*Absinthin*).—Caventou[5] obtained what he calls the *pure
rinciple* by precipitating an infusion of wormwood by acetate of lead, and sepa-
the excess of lead by sulphuretted hydrogen. The liquor was then evaporated
ness, and the extract digested in alcohol mixed with ether; and the solution
ned to spontaneous evaporation. The product was a very bitter matter, in
ramifications. By heat no crystalline sublimate could be obtained.

BSINTHIC ACID.—May be precipitated, according to Braconnot, from the watery
of wormwood by acetate of lead. It is very acid, uncrystallisable, and deli-
t. It does not precipitate the solutions of the nitrates of lead, mercury, and
but causes flocculent precipitates when dropped into barytes or lime-water.
ate of ammonia crystallises in quadrilateral prisms, insoluble in alcohol.

ALT OF WORMWOOD (*Sal Absinthii*).—This is impure carbonate of potash, ob-
by incinerating wormwood.

YSIOLOGICAL EFFECTS.—In *moderate doses* it produces the ordi-
effects of the *aromatic bitter tonics* (see *ante*). Its bitter principle
s absorbed: hence the flesh and milk of animals fed with it are

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[1] Pfaff, *Mat. Med.* iv. 334.
[2] *Bull. de Pharm.* v. 549.
[3] Geiger, *Handb. d. Pharm.* ii. 1509.
[4] *Journ. de Pharm.* xiv. 620.
[5] *Journ. de Chim. Méd.* t. iv. p. 556.

rendered bitter. Borrich[1] says that the milk rendered bitter by it prove noxious to the infant.

Large doses irritate the stomach and excite the vascular system. A specific influence over the nervous system, characterised by headache giddiness, &c., has been ascribed to it.[2] This has usually been supposed to depend on the volatile oil; but a similar power has been assigned to th bitter principle.

USES.— Wormwood is but little employed in medicine. It is adapte for dyspepsia occurring in debilitated and torpid constitutions. It was a one time celebrated for the cure of intermittents; but it has been superseded by other and more powerful febrifuges. It is said to be efficaciou as an anthelmintic, but is very rarely employed as such.

ADMINISTRATION.— Dose of the *powder*, ℈j. to ʒj.; of the *infusio* (prepared by macerating ℥j. of the dried herb in Oj. of boiling water) f℥j. to f℥ij.

Artemisia vulgaris, or *Mugwort*, has been employed in epilepsy, infantile convulsion chorea, hysteria, and amenorrhœa. But I suspect its powers are feebler than the preceding species.

224. Artemisia Moxa. *De Cand.*—Moxa-Weed.

Sex. Syst. Syngenesia, Polygamia superflua.

(Folia; Moxa.)

The *moxa* is a small mass (usually cylindrical or pyramidal) of combustible vegetabl matter, employed for effecting cauterisation (*moxybustion* of Percy[3]). It has long bee known that the Chinese and Japanese prepared it from a species of Artemisia,[4] whic Dr. Lindley[5] says is the *A. Moxa*, De Cand.; and Dr. Roxburgh[6] observes, that th *A. indica* has none of the soft white down on the under side of its leaves, of whic moxa is made in Japan and China.

The *Chinese* and *Japanese moxa* is said by some to be prepared from the cottony o woolly covering of the leaves of the Artemisia. Thunberg,[7] however, states that i Japan the dried tops and leaves are beat till they become like tow: this substance i then rubbed betwixt the hands till the harder fibres and membranes are separated, an there remains nothing but a fine cotton.

European moxas are usually made either with cotton-wool (which has been soake in a solution of nitrate or chlorate of potash) or the pith of the sun-flower (*Helianthu annuus*), which contains naturally nitrate of potash. Their shape is either cylindrica or conical; their size is variable. *Percy's moxas*, prepared by Robinet, are usuall found in the London shops. They consist of pith rolled in cotton and enveloped i muslin.

The physiological effects of the moxa are two-fold, *primary* and *secondary*. It firs excites an agreeable sensation of heat. This is speedily followed by pain, which progressively increases until it becomes most severe and the vitality of the part is destroyed. The parts immediately around the eschar are intensely red. The eschar ma be deep or superficial, according to the time the moxa is kept in contact with the ski The action of the moxa differs from that of the metallic actual cautery in this important particular, that the heat acts slowly, increases gradually, and penetrates to greater depth. The secondary effects consist in the production of inflammation, b

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[1] *Act. Hafn.* vol. ii. p. 165.

[2] See Lindestolpe, in Murray, *App. Med.*; and Kraus, *Heilmittell.* p 422.

[3] *Dict. Sc. Méd.* xxxiv. 474.

[4] Loureiro, *Fl. Cochinchinensis*, ii. 492; Thunberg, *Voyages au Japon*, &c. iv. 74.

[5] *Fl. Med.* 463.

[6] *Fl. Ind.* iii. 420.

[7] *Op. cit.*

the eschar is separated, and establishment of suppuration more or less profound,
ding to circumstances.

xa is employed in the treatment of diseases, on the principle of counter-irritation,
explained (see *ante.*) This, indeed, has been denied by those[1] who consider
roduction of a discharge as the only mode of effecting counter-irritation. It
pted for chronic diseases and maladies characterised by lesions of sensation or
n; and it is, on the other hand, injurious in all acute inflammatory diseases.
following is a list of the principal diseases against which it has been employed;
r further information respecting them, I must refer the reader to the writings of
y,[2] Boyle,[3] Wallace,[4] and Dunglison,[5] as the limits and objects of this work do
dmit of further details.—1. *Paralysis of the sentient or motor nerves.* Great
it has been obtained by the use of moxa in this class of diseases. Amaurosis,
ess, loss of voice and speech, hemiplegia, and especially paraplegia, have been re-
d by it. 2. *Painful affections of nerves, muscles,* or the *fibrous tissues;* as neuralgia,
ca, lumbago, and chronic rheumatism. 3. *Spasmodic diseases,* either of particular
or of the general system; as spasmodic asthma, epilepsy, &c. 4. *Diseased joints*
pinal maladies; as chronic articular inflammation, white swelling, stiff joints, hip-
disease, curvature of the spine, &c. 5. *Visceral diseases;* as organic diseases of
rain, phthisis pulmonalis, chronic hepatitis and splenitis, &c.

the employment of moxa, two points deserve especial attention; first, the parts
er or otherwise for its use; and secondly, the mode of applying it. It has been
ied to nearly every part of the body. Larrey, however, considers the following
improper for its application:—1. All that part of the skull covered by skin and
ranium only. 2. The eyelids, nose, ears, larynx, trachea, sternum, glandular
of the breasts, linea alba, and parts of generation. 3. Over the course of super-
tendons, articular prominences where there is danger of injuring the articular
ules, and projecting points of bone.

e mode of applying moxa is as follows:—Set it on fire at the summit, and apply
se (by a *porte-moxa,* fair of forceps, wire, or other convenient instrument) to the
To prevent the surrounding parts being burnt by sparks, Larrey recommends
to be previously covered with a wet rag, perforated in the centre, to admit the
of the moxa. If the combustion flag, it may be kept up by the breath, blow-pipe,
ellows. After the combustion is over, Larrey recommends the immediate applica-
of liquor ammoniæ, to repress excessive inflammation and suppuration.

225. Artemisia. ONE OR MORE SPECIES YIELDING WORMSEED.

e substance sold in the shops under the name of *Wormseed* consists of broken
ncles, mixed with the calyx and flower-buds of some species of *Artemisia.* It
been known by various names; as *semen-contra* (an abridgment of the Latin phrase
en contra vermes"), *semen santonicum, semen cinæ, semen sementina,* &c.

he sort usually found in English shops is that brought from the Levant (*semen cinæ*
nticum, halepense, vel *alexandrinum*), and which is considered to be the best. By
writers it is said to be the produce of Bucharia, and to come into Europe through
sia: hence it has been called *semen cinæ muscoviticum.* Guibourt[6] declares it to be
produce of *Artemisia Contra,* Linn. (*A. Sieberi,* Besser). But three other species,
A. Vahliana, A. pauciflora, and *A. Lercheana,* are also said to supply part of it.[7]
ary wormseed (*semen cinæ barbaricum* seu *africanum*) is considered by Guibourt
e the produce of *Artemisia glomerata* of Sieber. It consists of small globular
er-buds attached to the extremity of the branches. A third sort, called Indian or
Indian wormseed (*semen cinæ ostindicum*) has been described. It agrees with the
ary sort, except in colour, which is more greenish-yellow.

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[1] See Boyle, *Treat. on Moxa,* p. 88, 1825.
[2] *Dict. des Scien. Méd.,* art. *Moxa.*
[3] *Op. supra cit.*
[4] *Physiol. Enq. resp. Moxa,* 1827.
[5] *New Remedies.*
[6] *Hist. Nat. des Drogues simpl.* t. iii. p. 37, 4ème éd. 1850.
[7] Nees, Geiger's *Pharmacie,* 2te Aufl. 1839.

Wormseed has been analysed by Trommsdorff[1] and by Wackenroder.[2] The latt found in the Levant wormseed the following ingredients:—*volatile oil* 0·0039, *bitt matter* 20·25, *resinous bitter substance* 4·45, *green resin* 6·05, *cerin* 0·35, *gummy extra tive* 15·50, *ulmin* 8·60, *malate of lime* with a little *silica* 2·00, *woody fibre* 35·45, inte mixed *earthy matter* 6·70. More recently, a crystalline substance called *santonine cinin* ($C^{10}H^{6}O^{2}$) has been obtained from wormseed. It is odourless, bitter, and scarce soluble in cold water.

Wormseed is employed as a vermifuge in doses of from ʒj. to ʒij. repeated night a morning, and succeeded by a brisk purge.[3]

226. Tanacetum vulgare, *Linn.*—Common Tansy.

Sex. Syst. Syngenesia, Polygamia superflua.

(Folia.)

Tansy was ordered to be cultivated in gardens by Charlemagne.[4]

It is an indigenous plant, which is cultivated in gardens as a medicinal or pot-he or for ornament. The herb and flowers (*herba* et *flores tanaceti*) have a disagreea aromatic odour, and a nauseous, strong, aromatic, bitter taste. The infusion is re dered dark green and turbid (*tannate of iron*) by sesquichloride of iron. Both lea and flowers have been analysed by Fromherz and by Peschier.[5] The constituents of leaves, according to Peschier, are—*volatile oil*, *fatty oil*, *wax* or *stearine*, *chlorophy bitter resin*, *yellow colouring matter*, *tannin with gallic acid*, *bitter extractive*, *gum*, *woo fibre*, *tanacetic acid*. The *volatile oil* (*oleum tanaceti*) is yellow, but sometimes gre It has the peculiar odour of the plant, a warm bitter taste, and a sp. gr. of 0·952. T *bitter matter* is the substance usually denominated extractive; but, according to Pesch it is in part resin. *Tanacetic acid* is crystallisable, and precipitates lime, baryta, a oxide of lead, and causes a precipitate with a solution of acetate of copper.

Tansy produces the usual effects of the *aromatic bitter tonics* (see *ante*). "A fa case of poisoning with half an ounce of oil of tansy is recorded in the *Medical Ma zine*, Nov. 1834. Frequent and violent clonic spasms were experienced, with mu disturbance of respiration; and the action of the heart gradually became weaker death took place from its entire suspension. No inflammation of the stomach or bow was discovered upon dissection."[6] The young leaves are occasionally employed by cook to give colour and flavour to puddings, and in omelets and other cakes. In dicine, the plant is rarely employed by the regular practitioner; but it has been commended in dyspepsia, intermittents, and gout.[7] Its principal use, however, is a vermifuge. *Tansy tea* (prepared by infusing ℥ij. of the herb in Oj. of boiling wat may be taken in doses of from f℥j. to f℥iij. A drop or two of the *oil* may be added vermifuge powders and pills. The *seeds* have been used instead of *semina santonic*

227. ARNICA MONTANA, *Linn.*—MOUNTAIN ARNICA

Sex. Syst. Syngenesia, Polygamia superflua.

(Flores, Folia, et Radix.)

HISTORY.—This plant does not appear to have been known to ancients; at least no undoubted mention of it occurs in their writing

BOTANY. **Gen. Char.**—*Head* many-flowered, heterogamous. *Flore* y in one row, female, ligulate; of the disc, hermaphrodite, tubular, ied. *Involucre* campanulate, in 2 rows, with linear-lanceolate scales. *Receptacle* fringed, hairy. Tube of the *corolla* shaggy. ients of sterile *stamens* sometimes remaining in the ligulæ. *Style* disc with long arms, covered by down running a long way down, uncated or terminated by a short cone. *Achene* somewhat cylin-, tapering to each end, somewhat ribbed and hairy. *Pappus* in 1 omposed of close, rigid, rough hairs (De Cand.)

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[1] Trommsdorff's *Neue Journal*, Bd. iii.

[2] *Ibid.* Bd. xiv. 1827.

[3] For further details respecting the medicinal qualities of this drug, see Woodville's *Botany*, vol. ii. p. 337.—Woodville's *Artemisia santonica* is the *A. maritima*, var. β *suavol* of De Candolle.

[4] Sprengel, *Hist. Rei Herb.* i. 220.

[5] Gmelin, *Handb. d. Chem.* ii. 1290.

[6] *United States Disp.* from the *Am. Journ. of the Med. Sciences*, xvi. 256.

[7] Cullen, *Mat. Med.* ii.

Char.— Radical *leaves* obovate, entire, 5-nerved; the cauline ones r 2 pairs. *Stem* 1- to 3-headed. *Involucres* rough, with glands 'and.)

ennial. *Stem* hairy, about 1 foot high. *Florets* yellow, tinged with ı.

.— Meadows of the cooler parts of Europe, from the sea-shore to nits of eternal snow.

SCRIPTION.— The root (*radix arnicæ*) consists of a cylindrical x, from 2 to 3 inches long, and 2 or 3 lines thick, from which many arise. It is brown externally, has a disagreeable yet aromatic , and an acrid nauseous taste. The dried flowers (*flores arnicæ*) are vish, and have a similar taste and smell to the root. The leaves *arnicæ*) have a like smell.

MPOSITION.— Pfaff[1] found in the root *volatile oil* 1·5, *acrid resin xtractive* 32·0, *gum* 9·0, and *woody fibre* 5·5. The root has also examined by Weissenburger.[2] Chevallier and Lassaigne[3] analysed owers, and found in them *resin*, *bitter acrid matter* (*cytisin*), *yellow ing matter*, *gum*, *albumen*, and *gallic acid*. In the ashes were salts ash, and lime, and silica. Mr. Bastick[4] has announced the existence alkaloid, which he calls *arnicina*, in the flowers.

OLATILE OIL.—The oil obtained from the root (*oleum radicum arnicæ*, Cod. Ham- is yellowish, lighter than water (sp. gr. 0·94), and has a burning aromatic taste. n pounds of the dried root yield about an ounce of oil. The volatile oil of the is blue.

ESIN (*Arnicin*).—The acridity of the root and flowers resides, according to Pfaff, resin, which is soluble in alcohol.

XTRACTIVE MATTER.—According to Chevallier and Lassaigne, this is nauseous, bitter, and soluble in both water and spirit. They consider it to be analogous to

RNICINA.—Not volatile, bitter but not acrid, slightly soluble in water but more lcohol and ether. Its hydrochlorate is crystallisable (Bastick).

IYSIOLOGICAL EFFECTS. α. *On Animals.*— The effects of the rs of Arnica on horses have been examined by Viborg.[5] nfusion of six drachms of the flowers quickened the pulse, and acted liuretic. An infusion, thrown into the veins, caused insensibility.

On Man.— Jörg and his pupils have submitted themselves to the nce of this plant.[6] From their observations, as well as from the testimony of others, Arnica appears to possess acrid properties. Wh swallowed, it causes burning in the throat, nausea, vomiting, gastric pair and loss of appetite. The active principle becomes absorbed, quicke the pulse and respiration, and promotes diaphoresis and diuresis. Furthe more, it appears to exert a specific influence over the nervous syste causing headache, giddiness, and disturbed sleep. Sundelin [1] conside it to be closely allied in operation to senega, from which, he says, it diffe in its stimulating influence over the nervous system, and in its causi constipation.

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[1] *Mat. Med.* Bd. iii. S. 210.

[2] Goebel and Kunze, *Pharm. Waarenk.* Bd. ii. S. 177.

[3] *Journ. de Pharm.* t. v. p. 248.

[4] *Pharmaceutical Journal*, vol. x. p. 386, 1851.

[5] *Wirk. d. Arzneim. u. Gifte*, i. 231.

[6] *Ibid.* S. 226.

[According to Mr. Turk,[2] it has occasionally, when administered in lar doses, produced violent pain in the abdomen, with symptoms of impen ing abortion, and severe vertigo. In one case, tetanus, causing deat followed the use of a large dose of this plant, but was not very definite traceable to it.—ED.]

USE.—Arnica is indicated in diseases characterised by debilit torpor, and inactivity. It is administered as a stimulant to the gene system in various debilitated conditions, and in typhoid fevers; to t nervous system in deficient sensibility, as amaurosis; to the muscul system in paralysis; to the vascular system and secreting orga when the action of these is languid, and requires to have its ener increased, as in some forms of dropsy, chlorosis, amenorrhœa, and thenic inflammation. Furthermore, it has been employed empirically some maladies, as diarrhœa, dysentery, &c. It is rarely employed in t country internally, [but externally the tincture of the root has been us frequently as a liniment to bruises, &c.—ED.]

ADMINISTRATION.—1. *Of the flowers.* Dose of the *powder*, grs. to grs. x. mixed with syrup or honey to form an electuary. The *infusi* and *tincture* are more convenient preparations. *Infusum arnicæ (floru* Ph. Castr. Ruth., is made with ʒss. of the flowers to lbj. of water; do f℥j. to f℥ij. *Tinctura arnicæ (florum)*, Ph. Boruss., is prepared wi ʒiss. of the flowers to lbj. of rectified spirit: dose, fʒss. to fʒiss. 2. *Of the root.* This may be given in the form of infusion. *Infusi arnicæ (radicis)*, Ph. Castr. Ruth., is made with ℈ij. of the root to lbj. water: dose, f℥j.

TRIBE V. CYNAREÆ.

Style thickened upwards, and often fringed at the tumour.

228. Carthamus tinctorius, *Linn.*—Safflower or Bastard Saffron

Sex. Syst. Syngenesia, Polygama æqualis.

(Flosculi.)

Κνῆκος, Theophrastus, Hist. Pl. lib. vi. cap. 3 and 4; κνίκος, Dioscorid. lib. iv. c 190.—A native of the East Indies, where, as well as in many other parts of the wo gypt, South of Europe, South America, &c.), it is cultivated for commercial es.

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[1] *Hand. d. sp. Heilm.* ii. 170, 3tte Aufl.

[2] *Annuaire de Thérapeutique*, 1854, p. 46.

officinal parts are the florets, without the involucre. When dried, they constitute *flower* or *bastard saffron* (*flores carthami*) of the shops. They consist of the red r corolla divided superiorly into five segments, and inclosing the sexual organs. have a faint odour, allied to that of saffron, and a feeble bitterish taste. Accord- Dufour,[1] safflower consists of *red colouring matter* 0·5, *yellow colouring matter* d *yellow colouring matter* with *sulphates of lime* and *potash* 24·4, *extractive* with *colouring matter*, *chloride of potassium*, and *acetate of potash* 4·2, *resin* 0·30, *wax* *ody fibre* 49·6, *albumen* 5·5, *vegetable remains* and *sand* 4·6, *alumina* and *magnesia* *ide of iron* 0·2, *moisture* 6·2, loss 0·7.

yellow colouring matter is of the nature of extractive. Its formula, according to per,[2] is $C^{28}H^{10}O^{10}$. It is soluble in water, and is useless for dyeing. The *red* *ng matter* (*carthamine* or *carthamic acid*) is of a resinous nature. Its formula, ing to Schlieper, is $C^{14}H^{8}O^{7}$. It is soluble in alcohol and alkaline liquids, and is itable from its alkaline solution by acids. It is sparingly soluble in water, and is tly insoluble in ether. It is extracted from safflower (which has been deprived of low colouring matter by washing with water) by means of carbonate of soda. From kaline solution it is precipitated by acetic (or citric) acid. In the moist state it orted and sold under the name of *extract of safflower*. Spread on saucers and , it constitutes the *pink saucers* sold in the shops for dyeing silk. The colour which ids is beautiful but fugitive. Dried and mixed with French chalk (talc), car- n constitutes *rouge* (*rouge végétal*), which is used as a cosmetic. The Chinese rouge is a small folded card covered with a thin film of the colouring matter of the rer, which in this dried state has a golden green metallic brilliancy, but which, moistened, communicates a beautiful tint. Thin films of dried carthamin have a green metallic brilliancy, like the elytra of cantharides.

flower is sometimes used to adulterate hay saffron. The mode of detecting the has already been pointed out (see *ante*). What is called *cake saffron* (*crocus* *crata*) is made with safflower and mucilage (see *ante*).

e achenia of safflower are called seeds (*semina carthami*). They yield an oil by ssion, and were formerly used in medicine.

Sub-order II. LABIATIFLORÆ, *De Cand.*

Flowers hermaphrodite, usually 2-lipped.

his sub-order includes two tribes; viz.:—

TRIBE VI. MUTISIACEÆ.

TRIBE VII. NASSAUVIACEÆ.

either of these tribes contains any officinal plants.

Sub-order III. LIGULIFLORÆ, *De Cand.*

All the flowers ligulate and hermaphrodite.

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[1] *Ann. de Chim.* t. xlviii. p. 283, 1804.

[2] *Chemical Gazette*, vol. iv. p. 376, 1846.

TRIBE VIII. CICHORACEÆ.

Style cylindrical at the upper part; its arms somewhat obtuse, and equally pubesce

229. TARAXACUM OFFICINALE, *Wiggers.*—COMMON DANDELION.

Sex. Syst. Syngenesia, Polygamia æqualis.
(Redix recens, *L.* — Root, *E.*)

HISTORY.—As this plant is a native of Greece,[1] it must have be known to the ancients. Sprengel[2] and Fraas think that it is the ἀφά of Theophrastus.[3]

BOTANY. Gen. Char.—*Head* many-flowered. *Involucre* double; e ternal scales small, closely pressed, spreading, or reflexed; internal on in 1 row, erect; all frequently callous-horned at the apex. *Receptac* naked. *Achene* oblong, striated, muricate near the small ribs, or spin lose at the apex, terminating in a long beak. *Pappus* hairy, in ma rows, very white (De Cand.)

Sp. Char.—*Leaves* runcinate, toothed. *Achene* linear-obovate, blu and squamosely muricated at the summit, longitudinally striated, with long beak (Babington).

Root perennial. *Leaves* all radical, very variable, glabrous or slight hispid. *Scapes* single-headed, radical. *Florets* yellow.

Locality and other circumstances modify the characters of this species. Botanis are by no means agreed as to the number of its varieties. The following, consider by De Candolle and some others as distinct species, are regarded by Mr. Babington mere varieties, since they are quite connected by intermediate forms:—

I. Outer involucral scales reflexed or patent.

a. genuinum: outer scales linear, deflexed.—This variety is the *Leontodon Taraxac* of Smith and most botanists, the *Taraxacum Dens Leonis* of De Candolle. Glabrous woolly at the crown of the root. Leaves runcinate, broad. Flowers golden yello The head expanded in the morning and in fine weather. Achenes yellow, their upp half muricated. This is the variety which should be employed in medicine.

β. lævigatum: outer scales erecto-patent, ovate.—*T. lævigatum*, De Cand. Leav runcinate-pinnatifid, with unequal teeth. Achenes reddish-yellow, muricated at t summit, beak with a thickened and coloured base.

γ. erythrospermum: outer scales lanceolate, adpressed or patent.—*T. erythrosperm* De Cand. Leaves runcinate-pinnatifid, with unequal teeth and intermediate small ones. Achenes bright red, muricated at the summit; beak with a thickened and c loured base.—The lowermost leaves are sometimes obovate and dentate, not runcinat when it becomes *T. obovatum*, De Cand.

II. Outer scales adpressed.

δ. palustre: outer scales ovate-acuminate.—*Leontodon palustre*, Smith. Leaves o long and entire, sinuate-dentate, or runcinate. Florets often reddish externally. Achen pale yellow or brown, muricated at the summit.—*Taraxacum leptocephalum*, Reiche bach, is a sub-variety, with the outer involucral scales ovate-lanceolate or lanceolate.

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[1] See *Prodr. Fl. Græcæ*, ii. 129; and Fraas, *Synops. Pl. Floræ Class.* p. 201, 1845.
[2] *Hist. Rei Herb.* i. 100.
[3] *Hist. Plant.* vii. 81.

Hab.—Indigenous; very common—var. α in meadows and pastures everywhere, γ in dry places, δ in bogs.

DESCRIPTION.—The fresh root (*radix taraxaci*) is tap-shaped, branched, fleshy, and abounding in milky juice, which resides in the laticiferous tissue called by Grew[1] "milk vessels." Externally it is dull yellow or brownish, internally white. It is without odour: its taste is bitter (especially in the summer). The cold watery infusion of the dried root deposits a dirty-grey flocculent precipitate on the addition of sesquichloride of iron.

Mr. Giles[2] states that the roots of Rough Hawkbit (*Apargia hispida*, Willd.) are sometimes substituted for those of Dandelion. They may be distinguished thus:—the roots of Dandelion are smooth-skinned, tawny-coloured, crisp or easily frangible, and contain usually a milky juice; those of Hawkbit have a wrinkled cuticle, are pale-coloured, tough, break with difficulty, and rarely exhibit a milky juice. The leaves, when attached, also serve to distinguish the plants: those of Hawkbit are hairy, whereas the leaves of the genuine variety of Dandelion are smooth.

COMPOSITION.—C. Sprengel[3] analysed the *leaves* and *stems*, and found them to consist of 85 parts of water, 9·140 of matters extractible by water (viz. albumen, mucilage, gum, and sugar), 3·091 of matters extractible by dilute caustic potash ley, 0·100 of wax, resin, and chlorophylle, and 2·669 of fibre.

The *milky juice of the root* has been analysed by John,[4] who found in it *caoutchouc*, *bitter matter*, traces of *resin*, *sugar*, and *gum*, *free acid*, *phosphates*, *sulphates*, and *hydrochlorates of potash and lime*, and *water*. Mr. Squire[5] says the expressed juice contains *gum*, *albumen*, *gluten*, *an odorous principle*, *extractive*, and *a peculiar crystallisable bitter principle* soluble in alcohol and water.

In 1840 Frickhinger[6] made a comparative analysis of dandelion *root* gathered in November 1839 and of that collected in April 1840. His results were as follows:— (See TABLE, *next page*.)

From these analyses it appears that the root gathered in the autumn is richer in those ingredients which are extractible by water than the root collected in the spring; whereas the latter contains more albumen, wax, and mineral constituents (ashes).

Dandelion root washed, crushed, and pressed, yields about half its weight of juice. Except in the months of April and May, when it is very aqueous, this juice spontaneously coagulates, and becomes of a fawn colour. The quantity of extract obtained from the juice varies at different seasons.[7]

	Juice.	
In January and February..................	4 to 5 lbs.	yield 1 lb. of extract.
In March..	6 to 7 lbs.	ditto.
In April and May............................	8 to 9 lbs.	ditto.
In June, July, and August................	6 to 7 lbs.	ditto.
In September and October..............	4 to 5 lbs.	ditto.
In November and December.............	4 lbs.	ditto.

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[1] *Anatomy of Plants*, p. 104, tab. xiii. 1682.

[2] *Pharmaceutical Journal*, vol. xi. p. 107, 1851.

[3] Erdmann's *Techn. Journ.* Bd. v. S. 286: quoted by Wittstein (*Vollst. etymol. chem. Handwörterbuch*, Bd. 8. S. 915, 1847).

[4] Gmelin, *Handb. d. Chem.* ii. 1827.

[5] Brande's *Dict. of Mat. Med. and Pharm.* p. 532; and *Pharm. Journal*, vol. i. p. 424.

[6] Buchner's *Repert.* 2te Reihe, Bd. xxiii. S. 45, 1840.

[7] Squire, *op. cit.*

	Gathered in Autumn.		Gathered in Spring.	
	Fresh Root.	Root dried at 99°. 5F.	Fresh Root.	Root dried at 99°. 5F.
Extract prepared with cold water:—				
Part insoluble in alcohol (albumen, mannite, extractive, mucilage, with potash, soda, and lime, combined with muriatic, sulphuric, and phosphoric acids)	6·41	23·10	1·36	6·8
Part soluble in alcohol (extractive, sugar, mannite, and chloride of potassium)	3·66	13·20	3·45	17·2
Extract prepared by boiling the root in water:—				
Part insoluble in alcohol (inulin, potash, lime, phosphoric acid, and traces of sulphuric and muriatic acid)	3·04	11·20	0·88	4·4
Part soluble in alcohol (extractive, chloride of potassium, traces of tannin, lime, and sulphuric acid)	1·78	6·40	1·60	8·0
Albumen contaminated with some extractive	0·33	1·20	0·52	2·6
Wax	0·13	0·48	0·18	0·9
Residue exhausted by cold and boiling water.	9·16	33·00	9·02	45·0
Loss ascribable to the fermentation of the inulin	2·94	10·62	2·86	14·3
Loss	0·32	0·80	0·19	0·8
Water	72·23	—	79·94	—
	100·00	100·00	100·00	100·00
Ashes (carbonates of potash, soda, and lime; chloride of potassium; sulphates of potash and lime; phosphate of lime; and silica).	5·5		7·8	

It is obvious, then, that the expressed juice is richest in solid constituents in the months of November and December. It is remarkable, however, that the juice possesses the greatest bitterness in the summer months; while in the spring, and late in the autumn, it has a remarkably sweet taste.[1] Squire considers this change to be effected by the frost.

1. **TARAXACIN**; *Dandelion-bitter*.—This, which is probably the active principle of the root, is obtained by receiving the milky juice in distilled water, heating the liquid to boiling, by which the resin and albumen are separated, filtering the liquid when cold, and slowly evaporating, so that crystals may be formed. These may be purified by washing, and by solution in either distilled water or alcohol. Pure taraxacin occurs in stellated and dendritic masses, has a bitter and somewhat acrid taste, and is readily soluble in ether, alcohol, and boiling water, but difficultly so in cold water. It is easily fusible and inflammable, burns without developing ammonia, dissolves in concentrated acids without producing any colour, and is neutral to test papers.[2]

2. **RESIN**.—The resin obtained from the milky juice is white, crystallisable, soluble in alcohol and ether, but insoluble in caustic alkalies. Its spirituous solution has an acrid taste, and yields no precipitate on the addition of acetate of lead.

3. **INULIN**.—According to Overbeck,[3] the root collected in the spring yields very little inulin; but lbj. of the dried root collected in the autumn yielded him 2¼ ounces of inulin.

4. **SUGAR**.—This has been obtained from dandelion root by Widnmann,[4] by Frick-

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[1] Geiger, *Handb. d. Pharm.*

[2] Polex, *Arch. d. Pharm.* Bd. xix; *Berlinisches Jahrb. für d. Pharm.* Bd. xlii. S. 200, 1839; and *Pharmaceutical Journal*, vol. i. p. 425.

[3] *Arch. d. Pharm.* Bd. xxiii. S. 240.

[4] Buchner's *Repert.* Bd. xliii. S. 281, 1832.

hinger,[1] and by the Messrs. Smith.[2] It readily undergoes decomposition in the watery infusion of the root, and probably becomes converted into mannite and lactic acid.

$$\underbrace{C^{12}H^{12}O^{12}}_{\text{Grape-sugar.}} = \underbrace{C^{6}H^{7}O^{6}}_{\text{Mannite.}} + \underbrace{C^{6}H^{5}O^{5}}_{\text{Lactic acid.}}$$

Messrs. T. and H. Smith have confirmed the accuracy of Frickhinger's opinion,—that mannite does not pre-exist in taraxacum, but is a product of the decomposition of the sugar. I am indebted to them for a beautiful specimen of mannite procured from the infusion of dandelion.

PHYSIOLOGICAL EFFECTS.—Its obvious effects are those of a stomachic and tonic. In large doses it acts as a mild aperient. Its diuretic operation is less obvious and constant. In various chronic diseases its continued use is attended with alterative and resolvent effects. But where the digestive organs are weak, and readily disordered, taraxacum is very apt to occasion dyspepsia, flatulency, pain, and diarrhœa.

USES.—It is employed as a resolvent, aperient, and tonic, in chronic diseases of the digestive organs, especially hepatic affections; as jaundice, chronic inflammation or enlargement of the liver, dropsy dependent on hepatic obstruction, and dyspepsia attended with deficient biliary secretion. In some very susceptible conditions of the stomach it proves injurious. It has been employed in affections of the spleen, chronic cutaneous diseases, uterine obstructions, &c.

ADMINISTRATION.—It is employed in the form of either *decoction* or *extract*.

A mixture of coffee and either powder or extract of dandelion has been used at table under the name of *taraxacum* or *dandelion coffee;* and a mixture of four parts of dandelion powder with one part of chocolate constitutes the so-called *dandelion chocolate*.

[1. **INFUSUM TARAXACI**, U. S. Take of Dandelion bruised, ℥ij.; Boiling Water, Oj. Macerate for two hours in a covered vessel, and strain.—ED.]

2. **DECOCTUM TARAXACI**, L. E.; *Decoction of Dandelion.* (Bruised Taraxacum root, ℥iv.; Distilled Water, Oiss. Boil to a pint and strain, *L.*—Taraxacum, herb and root, fresh, ℥vij.; Water, Oij. Boil to a pint and strain, *E.*)—Aperient and tonic. Dose, f℥j. to f℥ij. To increase its aperient property, a saline purgative may be conjoined.

3. **EXTRACTUM TARAXACI**, L. E. U. S.; *Extract of Dandelion.* (Fresh root of Taraxacum, bruised, lb. iiss. [lb. j. *E.*]; Boiling Distilled Water, Cong. ij. [Cong. j. *E.*] Macerate for twenty-four hours, then boil down to a gallon, and strain the liquor while hot; lastly, evaporate to a proper consistence, *L.* "Proceed as for the preparation of extract of poppy-heads," *E.*)—Mr. Jacob Bell[3] gives the following as the average number of pounds of extract obtained from one hundredweight of the root at different periods of the year:—

Jan. 8½; Feb. 6¾; March 6; April 5; Aug. 6; Oct. 9; Nov. 8½; Dec. 9.

The following directions are given by the United States Pharmacopœia. Take of Dandelion gathered in September, vlb. Slice the dandelion, bruise it in a stone mortar, sprinkling on it a little water, until reduced to a pulp: then express the juice, strain and evaporate in a vacuum, or in a shallow dish over a water bath, constantly stirring, to the proper consistence.—ED.]

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[1] *Op. supra cit.*
[2] *Pharmaceutical Journal*, vol. viii. p. 480, 1849.
[3] *Ibid.* vol. x. p. 446.

Extract of taraxacum should be brownish, not blackish. Its taste is bitter and aromatic: that of the shops is usually more or less sweet. It should be completely soluble in water. — Dose, grs. x. to ʒss.

230. LACTUCA SATIVA, *De Cand.*—THE GARDEN OR COS LETTUCE.

Lactuca sativa. var *a*, *Linn.*

Sex. Syst. Syngenesia Polygamia æqualis.

(Herba florens, *L.* — Inspissated juice, *E.* — Inspissated juice and leaves, *D.*)

HISTORY.—The θρίδαξ, or *Lettuce*, was well known to the ancient Greeks and Romans. It is mentioned by Hippocrates[1] both as an aliment and medicine; and by Dioscorides.[2] It is probable that the θρίδαξ ἥμερος of the latter writer is our Lactuca sativa.[3] "The sedative powers of *Lactuca sativa*, or Lettuce, were known," observes Dr. Paris,[4] "in the earliest times; among the fables of antiquity we read that, after the death of Adonis, Venus threw herself on a bed of lettuces to lull her grief and repress her desires."

BOTANY. **Gen. Char.**—*Heads* many- or few-flowered. *Involucre* cylindrical, calyculate-imbricate, in 2 or 4 rows; outer rows short. *Receptacle* naked. *Achenes* plane, obcompressed, wingless, abruptly terminating in a filiform beak (De Cand.)

Sp. Char.—*Leaves* not concave, erect, oblong, narrowed at the base, smooth at the keel. *Stem* elongated, leafy (De Cand.)

Annual. *Stem* erect, simple below, branched above, 1 or 2 feet high, smooth. *Leaves* rounded or ovate, semi-amplexicaul, frequently wrinkled, usually pale green; varying much in the different varieties. *Flowers* yellow.

Hab.—Native country unknown: perhaps the East Indies. Extensively cultivated in Europe under the name of the *Cos Lettuce* (*Laitue romaine, Lactuca romana*).

LACTUCA CAPITATA, De Cand., or *Cabbage Lettuce*, and L. CRISPA, De Cand., or *Curled Lettuce*, were considered by Linnæus to be varieties of L. sativa.

DESCRIPTION.—1. *Lettuce leaves* (*folia lactucæ*) are exclusively used as a salad. They are gathered early, before the flower-stem shoots up, and then contain a cooling, bland, pellucid, watery juice. 2. The *flowering plant* (*herba florens*, L.) contains an intensely bitter, milky, slightly narcotic juice, having an odour allied to that of opium. This juice resides in the root, cortical portion of the stem and branches, and in the involucre. 3. *Lactucarium*, or *Lettuce Opium*, is the inspissated milky juice.

COMPOSITION.—In the young state in which the plant is usually brought to table, its juice consists chiefly of *water*, *mucilage*, *albumen*, and *saccharine matter*. But in the flowering state the juice also contains *resin*, a *peculiar waxy substance* (lactucerin), and a *crystalline bitter substance*

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[1] *De Diæta*, ii. p. 359; and *De Morb. Mul.* i. 629. and 635.

[2] Lib. ii. cap. 165.

[3] This also is the opinion of Fraas (*Synops. Plant. Fl. Classicæ*, p. 199, 1845).

[4] *Pharmacol.* vol. i. p. 13, 6th ed.

(lactucin). Pagenstecher[1] obtained from the distilled water of lettuce an odorous sulphuretted *volatile oil.* (See also the composition of *Lactucarium* from *Lactuca sativa*, p. 37.)

The decoction of the flowering herb is rendered dark green and turbid by the salts of the sesquioxide of iron.

PHYSIOLOGICAL EFFECTS.—The early leaves of the lettuce, eaten as a salad, are easily digested, but they yield only a small portion of nutritive matter. They probably possess, in a very mild degree, soporific properties. The ancients considered them anti-aphrodisiac. The flowering plant is more powerful, and produces, in a feeble degree, the effects of lactucarium (see p. 37).

USES.—Lettuce leaves are employed at the table as a salad. As they appear to possess slight hypnotic properties, they may be taken with advantage at supper, to promote sleep. Galen,[2] who in his old age was troubled with watchfulness, was relieved by the use of lettuce at night. On the other hand, prudence points out the propriety of abstaining from the use of this plant if there be any tendency to apoplexy.

EXTRACTUM LACTUCÆ, French Codex; *Thridace* vel *Thridacium.*—This is sometimes called *French Lactucarium* (*Lactucarium gallicum*). It is an extract obtained by evaporating the juice expressed from the stalks of the lettuce at the flowering season. This extract has not been analysed. Its composition must resemble that of the juice above noticed. Meissner detected a trace of copper in one specimen. In its effects and uses it resembles, but is much inferior to, Lactucarium. Ganzel[3] found that 10 grains of the extract of lettuce introduced into the cellular tissue of the thigh of a small dog killed the animal in three days.

231. LACTUCA VIROSA *Linn.*—STRONG-SCENTED LETTUCE.

Sex. Syst. Syngenesia Polygamia æqualis.
(The inspissated juice. *E.*—Leaves; Inspissated juice, *D.*)

HISTORY.—According to Sprengel[4] and Fraas,[5] this is the ϑρίδαξ ἀγρία of Dioscorides;[6] but Dr. Sibthorp[7] suggests that *Lactuca Scariola* was the plant referred to by Dioscorides.

BOTANY. **Gen. Char.**—See *Lactuca sativa.*

Sp. Char.—*Stem* erect, round; the base smooth or prickly-setose; the apex panicled. *Leaves* horizontal, prickly-setose at the keel, acutely denticulate, obtuse, at the base arrow-shaped; the lower ones sinuate. *Achenes* striated, usually shorter than the beak (De Cand.)

Herb abounding in fetid milky juice. *Root* tap-shaped. *Stem* 2 to 4 feet high. *Leaves* distant. *Florets* yellow.

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[1] Buchner's *Repertorium*, 2te Reihe, Bd. xxiii. S. 17, 1840.
[2] *De aliment. facult.* lib. ii. cap. 40.
[3] Quoted by Buchner, *Repert.* Bd. xlii. 2te Reihe, 1847.
[4] *Hist. Rei Herb.* i. 185.
[5] *Synops. Plant. Fl. Class.* 1845.
[6] Lib. ii. 166.
[7] *Prodr. Fl. Græc.* ii. 126.

Hab.—Indigenous; about hedges, old walls, and borders of fields; not uncommon. Biennial. Flowers in August and September.

LACTUCA VIROSA, var. β MACULATA, De Cand.—This variety is distinguished by the purplish-red stems, and the blood-red or purplish-red spots on the obovate radical leaves.

DESCRIPTION.—1. *The leaves of the strong-scented lettuce* (*folia lactucæ virosæ*), and other parts of the plant, contain, during the flowering season, a milky juice which has a strong opiate-like odour and bitter taste. The leaves of this species, as well as of *L. Scariola*, are distinguished from those of *L. sativa* by the prickles on the keel of the leaves. 2. *Lactucarium* is obtained from *L. virosa* as well as from *L. sativa*.

COMPOSITION.—The fresh milky juice[1] reddens litmus paper, and is coagulated both by acids and alcohol. It contains *lactucin*, *odorous matter* (volatile oil?), *extractive matter*, *lactucerin*, *albumen*, *resin*, and some *salts* (viz. a vegetable salt of potash, nitrate and sulphate of potash, chloride of potassium, sal ammoniac, and some calcareous and magnesian salts). By exposure to the air it becomes first yellow and afterwards brown, and gradually solidifies. In this state it constitutes *lactucarium*, the composition of which will be stated hereafter.

PHYSIOLOGICAL EFFECTS.—The experiments of Orfila[2] on dogs show that this plant possesses narcotic qualities; but its powers are not very great, and have been probably much over-rated. A solution of the extract, thrown into the veins, caused heaviness of head, slight drowsiness, feebleness of the hind extremities, difficult and frequent respiration, slight convulsive movements, and death. Glaser[3] considers it to possess acrid properties. On Wibmer, two grains of the extract caused sleepiness and headache. Its activity depends chiefly on the lactucin.

USES.—It is employed only to furnish lactucarium.

ANTIDOTES.—In cases of poisoning by *Lactuca virosa*, the treatment should be the same as that for poisoning by opium.

LACTUCARIUM, *E.D.*—LETTUCE OPIUM.

HISTORY.—This is the inspissated milky juice (obtained by incision of the stem) of *Lactuca sativa* and (chiefly) *L. virosa*.[4] It was first collected and employed by Dr. J. R. Coxe,[5] of Philadelphia.

But the term "lactucarium" has also been applied to other preparations of the lettuce. Thus Dr. Duncan, Sen.[6] who first employed the term, used it to indicate the extract obtained by evaporating the tincture made with weak spirit of wine; and in France the term is frequently applied to the extract obtained by evaporating the expressed juice.

COLLECTION.—In the young state, the plant abounds in a cooling, bland, slightly bitterish, pellucid, watery juice. At this period, while it consists chiefly of a bunch of succulent leaves, *L. sativa* is employed at table as a very agreeable salad. As the flowering period approaches, the stem shoots up above the early leaves, and the juice of the plant becomes milky and bitter, and acquires a smell allied to that of opium. When incisions are made into the stem, this milky juice exudes, and, by exposure to the air, dries and becomes the brown solid called *lactucarium* or *lettuce-opium*. The incisions are effected either by cutting off the top of the stem and removing a fresh slice as often as the surface ceases to yield juice, or by cutting the sides of the stem. The exuded juice is removed by the finger, or by scraping with a knife, placed in a glass or earthenware vessel, and allowed to dry spontaneously.

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[1] For a good summary of the known properties of the milky juice, see Buchner, *Repertorium*, Bd. xlvii. 2te Reihe, 1847.

[2] *Toxicol. Gén.*

[3] Wibmer, *Wirk. d. Arzn. u. Gift.* Bd. iii. S. 200.

[4] Aubergier (*Comptes rendus*, xv. 923) states that he obtained the largest quantity of lactucarium from *L. altissima* of Bieberstein,—a Caucasian plant.

[5] *Transactions of the American Philosophical Society*, vol. iv. p. 388, 1799.

[6] *Observations on the Preparation of Soporific Medicines from common Garden Lettuce*, read in the Caledonian Horticultural Society, March 6, 1810 (*Mem. of the Caledon. Hort. Soc.* vol. i. p. 160.)—Also, *Observ. on the Distinguishing Symptoms of Three different Species of Pulmonary Consumption*, p. 159, 1813.

By drying in the air, the milky juice of *L. virosa* loses about half its weight of water, and yields from 50 to 55 per cent. of lactucarium.[1] According to Mr. Duncan,[2] after the middle period of inflorescence, although the juice becomes thicker, it contains a less proportion of bitter extract, and, therefore, is less fit for yielding lactucarium. The quantities of lactucarium obtained by Schultz[3] from one plant of the following species were—from *L. sativa* 17 grains, *L. scariola* 23 grains, and *L. virosa* 56 grains.

PROPERTIES. — *Lactucarium* or *lettuce-opium*, as usually found in the shops of this country, is in small lumps, which are seldom larger than a pea or small bean: they are rough and irregular on the surface, sometimes covered with an ash-grey efflorescence, of a brown or reddish brown colour, friable, with an opiate smell and bitter taste. This sort agrees with that said by Dr. Christison to be the lactucarium obtained from *L. virosa* in the neighbourhood of Edinburgh.

Lactucarium from *L. sativa* is said by Dr. Christison to occur in roundish, rather compact, masses weighing several ounces.

Lactucarium prepared by Aubergier, pharmacien at Clermont, for commercial purposes, is in round flat cakes, of from 10 to 30 grammes (= 154·3 grs. to 463 grs. troy) each, and is often covered with a whitish efflorescence of mannite.[4]

COMPOSITION. — Lactucarium has been the subject of repeated analysis. That obtained from *L. sativa* has been analysed by Klink,[5] Schrader,[6] Peschier,[7] and Peretti.[8] Pagenstecher[9] has also contributed to our knowledge of it. Lactucarium from *L. virosa* has been analysed by Klink,[10] Buchner,[11] Schlesinger,[12] Walz,[13] and Ludwig.[14] Lastly, that from *L. altissima* has been examined by Aubergier.[15]

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[1] Buchner, *Repertor*. Bd. xliii. S. 21, 1832.

[2] Christison, *Dispensatory*, 2d ed. p. 588, 1848.

[3] Buchner's *Repertor*. Bd. xv. S. 272, 1823; Berlin, *Jahrb*. Bd. xxvi. Pt. 1, S. 227.

[4] Guibourt, *Hist. Nat. des Drog. simpl.* t. iii. p. 13. 4ème éd. 1850.

[5] *Diss. inaug. sistens Lactucæ virosæ et sativæ Analys. Chem.* Kiel, 1820 (Pfaff's *Mat. Med.* vi. S. 504, 1821.)

[6] Gmelin, *Handb. d. Chemie*.

[7] Wittstein's *Etym.-chem. Handworterbuch*, Bd. i. S. 873.

[8] *Pharm. Central-Blatt für* 1831, S. 467.

[9] Buchner's *Repertorium*, 2te Reihe, Bd. xxiii. S. 17. 1840.

[10] *Diss.* supra cit.

[11] *Repertorium*, Bd. xliii. S. 1, 1832.

[12] *Ibid.* 2te Reihe, Bd. xvii. S. 170, 1839.

[13] *Ibid.* 2te Reihe, Bd. xxiii. S. 20, 1840; and *Pharm. Central-Blatt für* 1840. S. 59.

[14] *Pharm. Central-Blatt für* 1847, S. 438.

[15] *Comptes rendus*, t. xv. p. 78, 1843.

LACTUCARIUM.

FROM LACTUCA SATIVA.

Klink's Analysis.

Bitter extractive	55·0
Wax	10·0
Resin	6·9
Caoutchouc	17·5
Water	15·6
Lactucarium	105·0

FROM L. ALTISSIMA.

Aubergier's Analysis.

A crystallisable bitter substance.
Two resins.
Wax.
Mannite.
Pectin.
Asparamide.
Albumen.
A crystallisable substance, convertible into humus under the influence of alkalies.
Salts.

FROM L. VIROSA.

Buchner's Analysis.

Odorous matter	undetermined
Lactucin, with colouring matter	18·6
Gummy extractive	14·666
Soft resin, with waxy matter	12·467
Waxy matter (myricin)	35·100
Gluten or albumen	19·100
Air-dried Lactucarium	99·933

Ludwig's Analysis.

1. Matters insoluble in water:		
Lactucerin	42·64	48·63
Very fusible wax	3·99	
Vegetable fibre	2·00	
2. Matters soluble in water:		
Albumen	6·98	51·37
Bitter extractive	27·68	
Watery extractive insoluble in alcohol	14·96	
Lactucerin rendered soluble by other substances	1·75	
		100.00

Buchner more recently has given the following estimate, founded on Ludwig's analysis, of the per-centage composition of lactucarium:—*Lactucin*, in combination with other substances soluble in water and spirit of wine, 28; (the weight of the *odorous matter*, the *asparamide*, and two imperfectly examined *vegetable acids*, was not determined;) *salts*, as constituents of the ashes, and including 1 per cent. of oxalic acid, 7; *mannite*, 2; *albumen*, 7; *insoluble vegetable substances*, 2; *lactucerin* (lactucon), 44; *waxy matter* and *soft resin*, 4; *gummy matter; proteine*, which Aubergier found in the lactucarium of L. sativa, and which is probably also present in that of L. virosa, and *water*, 6.

The active principles appear to be the *lactucin* and *odorous matter*, to which Buchner adds the *salts*. The substances which are insoluble in cold spirit of wine and hot water possess no medicinal power.

1. ODOROUS MATTER; *Volatile Oil?*—This substance resembles in smell the odorous matter of opium. When lactucarium is submitted to distillation with water, the odorous principle distils over. Its nature has not been accurately determined. Both Pagenstecher and Walz have obtained a volatile oil, which the former chemist states contained sulphur. From the experiments of Buchner and Walz, it appears to be a basic substance; but Ludwig declares it to be of an acid nature.

2. LACTUCIN; *Bitter Principle of Lactucarium.*—This is a colourless, odourless, crystallisable, fusible, neutral substance. It requires 60 to 80 parts of water to dissolve it; and is readily soluble in alcohol, but less so in ether. Its watery solution is unaffected by acetate of lead, chloride of iron, and nitrate of silver; but, mixed with soda and nitrate of silver, it reduces the precipitated oxide of silver to the metallic state; and mixed with sulphate of copper and soda, and heated to boiling, it reduces the oxide of copper to the state of protoxide. It was obtained by Ludwig thus: 80 parts of lactucarium were rubbed with 80 parts of cold dilute sulphuric acid for half an hour, and then mixed with 400 parts of rectified spirit. The liquid being filtered, slacked

lime was added to it to precipitate the sulphuric acid, and the solution was then evaporated. The brown viscid extract was digested in water, the solution treated by animal charcoal, and filtered and evaporated so as to yield crystals of lactucin.

3. LACTUCERIN; *Lactucon; Waxy Matter of Lactucarium.*—A neutral crystalline substance insoluble in water, but soluble in alcohol, ether, and the fixed and volatile oils. Its formula is $C^{40}H^{32}O^{3}$.

The *lactucic acid* of Pfaff is declared by Walz to be oxalic acid.

A strong though unfounded suspicion appears to have been entertained, that *morphia* was contained in lactucarium. But in none of the before quoted analyses was it to be found; neither was Caventou[1] able to detect an atom of either morphia or narcotin in lactucarium.

CHARACTERISTICS.— The cold aqueous decoction of lactucarium becomes, on the addition of sesquichloride of iron, olive-brown (*tannate? of iron*). Tincture of nutgalls renders the decoction slightly turbid. Heated with lactucarium, colourless nitric acid acquires an orange-yellow tint, and evolves binoxide of nitrogen. The alcoholic tincture of lactucarium becomes slightly turbid on the addition of water.

PHYSIOLOGICAL EFFECTS. — Lactucarium possesses anodyne and sedative qualities: but its powers have, I suspect, been over-rated. Ganzel[2] states, that ten grains introduced into the cellular tissue of a dog's leg caused deep sopor, with occasional convulsions, but no dilatation of the pupil. Francois,[3] who made a considerable number of trials of it, observes that it contains neither a narcotic nor an intoxicating principle; but that it allays pain, diminishes the rapidity of the circulation, and, in consequence, reduces the animal heat, and places the patient in a condition more favourable to sleep. Its *modus operandi* is different from that of opium; for the latter substance accelerates the pulse, and produces either delirium or stupor. It is more allied to hyoscyamus, from which, according to Fisher,[4] it is distinguished by its power of directly diminishing sensibility, being preceded by irritation of the nervous system. Buchner compares the action of lactucin to that of digitalin, and says it diminishes the force and frequency of the pulse and the animal heat, dilates the pupil, and causes sleep and stupor. A more extended experience of the use of lactucarium, however, is requisite to enable us to form accurate conclusions as to the precise nature and degree of its powers.

USES. — It is employed as an anodyne, hypnotic, antispasmodic, and sedative, where opium is considered objectionable, either from peculiarities on the part of the patient or from the nature of the disease. Thus it may be used where there is morbid excitement of the vascular system, in which condition opium is usually contra-indicated. But though it is free from several of the inconveniences which attend the use of opium, yet it is much less certain in its operation. It may be given with advantage to allay cough in phthisis and other pulmonary affections;[5] to relieve nervous irritation and watchfulness in febrile disorders in which opium is not admissible. Dr. Rothamel[6] has employed it with success in different kinds of fevers, inflammations, exanthemata, profluviæ, cachexies, and painful and peculiar nervous disorders. Vering[1] found it especially useful in spasm of the uterus; and Angelot gave it to repress seminal discharges.

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[1] *Journ. de Chim. Méd.* i. 300.

[2] Sundelin, *Handb. d. sp. Heilm.* Bd. i. S. 459, 3tte Aufl.

[3] *Arch. Gén. de Méd.* Juin 1825, p. 264.

[4] *Lond. Med. Gaz.* xxv. 563.

[5] Duncan, *Observ. on Pulm. Consump.* 1813.

[6] Dierbach, *Neuest. Entd. in d. Mat. Med.* S. 118, 1837.

Administration. — The usual dose is from grs. iii. to grs. v.; but it has been given in larger quantities, as from grs. x. to grs. xx.

1. **TINCTURA LACTUCARII**, E.; *Tincture of Lactucarium.* (Lactucarium, in fine powder, ℥iv.; Proof Spirit, Oij. This tincture is best prepared by percolation, as directed for tincture of myrrh; but may also be prepared by digestion with coarse powder of lactucarium.) — As lactucin (the bitter principle of lactucarium) is soluble in proof spirit, this liquid is a fit menstruum for preparing the tincture.

2. **TROCHISCI LACTUCARII**, E.; *Lozenges of Lactucarium.* (To be prepared with lactucarium in the same proportion and in the same manner as the Opium Lozenge). — Each lozenge weighs ten grains, and contains nearly one-sixth of a grain of lactucarium.

232. Cichorium Intybus, *Linn.*—Wild Succory or Chicory.

Sex. Syst. Syngenesia Polygamia æqualis.

(Radix.)

Κιχώριον, Theophrast. Hist. Plant. lib. vii. cap. 11; *σέρις στενόφυλλος καί ἔμπικρος* [narrow-leaved and bitterish Seris], Dioscorides, lib. ii. cap. 160; *Intybum erraticum*, called by some *ambula* [or *ambugia*], and in Egypt *Cichorium*, Pliny, Hist. Nat. lib. xx. cap. 29, ed. Valp.

Stem 2-3 feet high, bristly, alternately branched. Lower leaves runcinate, hispid in the keel; upper ones oblong or lanceolate, clasping, entire. Flower heads axillary, in pairs, nearly sessile, bright blue, sometimes white, about the size of those of dandelion. Involucrum roughish. Corollæ, anthers, and stigmas, blue. Fruit angular. — A perennial herb; indigenous, growing on banks on a gravelly and chalky soil. Flowers in July and August. Cultivated in various parts of England; also in Belgium, Holland, Germany, and France.

The root (*radix cichorii sylvestris* vel *agrestris*) is spindle-shaped, with a single or double head; externally it is whitish or greyish-yellow, internally it is whitish, fleshy, and milky. Its taste is bitter. English roots are usually smaller and more fibrous than the foreign roots.

Both in the raw and roasted roots, the structures which are observed by microscopic examination are cellular tissue, pitted tissue (dotted ducts), vascular tissue (spiral vessels), and lactiferous tissue (milk vessels). The dotted ducts are unbranched: the milk vessels, on the contrary, are anastomosing vessels.[2]

No recent analysis of the root has been made. John[3] obtained from 100 parts, 25 parts of watery *bitter extractive*, 3 parts of *resin*, besides *sugar*, *sal ammoniac*, and *woody fibre*. Waltl[4] procured *inulin* from it. In one experiment, half a pound (civil weight) of the root yielded him one ounce of good dry inulin; but, in another much sweeter root, he found not a trace of inulin. Hence he inferred that the sugar had been formed at the expense of the inulin. An infusion of the root, mixed with syrup, becomes thick; forming the *gomme saccho-cichorine* of Lacarterie.[5]

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[1] Dierbach, *Neuest. Entd. in d. Mat. Med.* S. 119.

[2] Figures of some of these tissues are given in the *Lancet* for March 15, 1851.

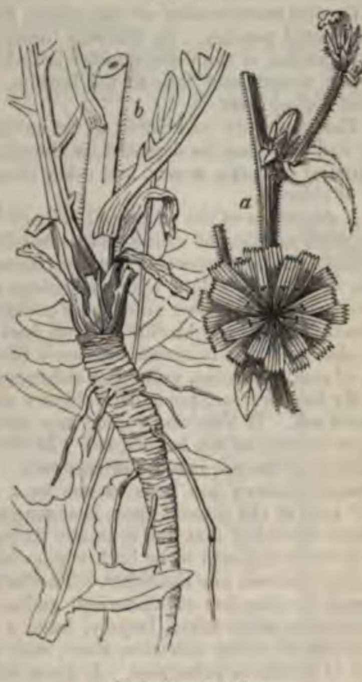
[3] *Chem. Tabelle d. Pflanzenanalysen*, p. 81 (quoted by Kunze).

[4] Buchner's *Repertorium*, Bd. xxvii. S. 263, 1827.

[5] Fée, *Cours. d'Hist. Nat.* t. ii, p. 301, 1828.

The fresh root is seldom or never used at the present day as a medicine. Its medicinal properties appear to resemble those of dandelion. It is reputed to possess tonic, alterative, resolvent, diuretic, and, in large doses, aperient qualities: and it was formerly employed in chronic diseases of the abdominal viscera, jaundice, hypochondriasis, &c. Its protracted use is said to injure digestion. It is administered in the form of decoction, prepared by boiling ℥ss. of the dried root, in Oj. of water, to f℥viij.[1]

FIG. 5.



Cichorium Intybus.
Wild Chicory.

RADIX CICHORII TORREFACTA; *Roasted Chicory root.*—On the large scale, chicory root is roasted in heated iron cylinders, which are kept revolving, as in the process of coffee-roasting. The loss during the process is from 25 to 30 per cent.

During the roasting process, about 2lbs of lard for every cwt. of chicory are added. This substance is intended to give the chicory a face or lustre like that of coffee.[2] While roasting, chicory evolves a not disagreeable odour, which somewhat resembles that of burnt gingerbread.

Roasted chicory, when ground to powder, constitutes the *chicory* sold for the adulteration of coffee, and sometimes called *chicory-coffee*. The adulteration of coffee with chicory can be detected by the microscope, as well as by chemical means (see *Coffea arabica*).

Roasted chicory powder, when thrown on water, rapidly imbibes this fluid—to which it communicates a reddish brown colour—and falls to the bottom of the vessel. A decoction of roasted chicory is merely rendered brown by iodine, and neither strikes a blue colour with iodine nor becomes black on the addition of the sesquichloride of iron.

When submitted to microscopic examination, roasted chicory presents the scalariform tissues which are observed in the raw root; the operation of roasting not having destroyed them.

Roasted chicory is extensively adulterated. To colour it, Venetian red (see *ante*), and perhaps reddle, are used. The former is sometimes mixed with the lard before this is introduced into the roasting machine, at other times it is added to the chicory during the process of grinding. Roasted pulse (peas, beans, and lupines),[3] corn (rye and damaged wheat), roots (parsnips, carrots, and mangel-wurzel), bark (oak-bark tan), wood-dust (logwood and mahogany dust), seeds (acorns and horse-chesnuts), the marc of coffee, coffee-husks (called *coffee-flights*), burnt sugar, baked bread, dog-biscuit, and the baked livers of horses and bullocks (!), are substances which are said to have been used for adulterating chicory. A mixture of roasted pulse (peas usually) and Venetian red has been used, under the name of *Hambro' powder*, for the same purpose.[1]

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[1] Wylie, *Pharm. Castrens. Ruthenica*, 1840.

[2] In France, butter is used instead of lard. This addition is by some said to "fix" the red powders used for the adulteration of chicory (Chevallier, *Journ. de Chim. Méd.* t. v. 3me Sér. p. 280, 1849).

[3] Lupine seeds are said to be imported from Egypt, and, when roasted and ground, are sold under the name of "Coffina" (*Lancet*, March 15, 1851).

The following are the chief modes of examining chicory, with the view to the detection of these adulterations:—

1. Careful examination of the odour, flavour, and appearance to the naked eye, of the suspected powder. In this way foreign substances may sometimes be detected.

2. A portion of the dried powder is to be thrown on water: the chicory rapidly imbibes the water, and falls to the bottom, whereas some intermixed powders (as the marc of coffee) float.

3. The suspected powder is to be submitted to careful microscopical examination. Pulse and corn may be detected by the size, shape, and structure of the starch grains. The tissues of barks, woods, and other roots, may also be frequently distinguished from those of chicory.

4. A decoction of the suspected chicory is then to be prepared, and, when cold, to be tested with solution of iodine and persulphate of iron.

Iodine colours a decoction of pure chicory brownish; whereas it produces a purplish, bluish, or blackish colour with decoctions of roasted pulse, roasted corn, baked bread, roasted acorns, and other substances containing starch.

Persulphate or perchloride of iron does not produce much effect on a decoction of pure chicory; but it communicates a bluish or blackish tint to a decoction of oak-bark, of roasted acorns, and other substances containing tannic or gallic acids.

5. By incineration, pure dried chicory yields from 4 to 5 per cent. of a grey or fawn-coloured ash. If Venetian red or any earthy or other mineral substances be present, a larger amount of ash is obtained. Moreover, when Venetian red has been employed, the colour of the ash is more or less red.

Roasted chicory has been in use as a substitute for coffee for more than eighty years,[2] and, at the present time, is extensively employed for adulterating coffee. It is, however, devoid of that fine aromatic flavour for which coffee is so much admired. By some persons it is said to be both wholesome and nutritive, by others it is declared to be neither the one nor the other. The fact is, that no obvious ill effects are usually observed by the use of chicorised coffee; but there can be no doubt that roasted chicory must, when taken largely, have a tendency to excite diarrhœa. It scarcely deserves to be called nutritive, since, with the exception of sugar, it is almost entirely devoid of nutritive principles. It gives colour and apparent strength to coffee of inferior quality.

ORDER LV. VALERIANACEÆ, *Lindl.* — VALERIANWORTS.

VALERIANEÆ, *De Candolle.*

CHARACTERS. — Tube of the *calyx* adnate to the ovary; the limb various, either dentate or partite, or changed into a pappus, which is at first involute, afterwards expanded. *Corolla* tubular, funnel-shaped; usually 5-lobed, rarely 3- or 4-lobed; lobes obtuse; tube equal or gibbous, or calcarate at the base. *Stamens* adnate by their *filaments* to the tube of the corolla; free at the apex; alternate with the lobes of the corolla; 5 (the type), 4, 3, 2, or solitary; *anthers* ovate, bilocular. *Style* filiform; *stigmas* 2 or 3, free or cohering. *Fruit* membranous or somewhat nucamentaceous, indehiscent, crowned, at least when young, with the limb of the calyx, either 3-celled (2 cells being empty) or 1-celled. *Seeds*, in the fertile cell or fruit, solitary, pendulous, exalbuminous; *embryo* erect, with a superior radicle and 2 flat cotyledons (De Cand.)—Annual or perennial *herbs*, rarely at the base somewhat shrubby. *Roots* of the perennial species odorous. *Leaves* opposite, without stipules. *Flowers* cymose-corymbose.

PROPERTIES.—The rhizomata and their rootlets contain a peculiar, odorous volatile oil, on which their nervine and antispasmodic qualities essentially depend.

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[1] For further details respecting the adulteration of chicory, see a paper by the author in the *Pharmaceutical Journal*, vol. iv. p. 119: also Chevallier, *Journ. de Chim. Méd.* t. v. p. 276, 3me Série, 1849; and *The Lancet* for January 4, March 15, May 10, and Nov. 1, 1851.

[2] F. G. Constantini *Nachricht von d. Cichorienwurzel*, Hannover, 1771; C. G. Förster, *Geschichte von d. Erfindung u. Einführung d. Cichorien-Coffee*, Bremen, 1773. See also Chevallier, *Journ. de Chim. Méd.* t. v. p. 276, 3me Série, 1849.

233. VALERIANA OFFICINALIS, *Linn.*—COMMON VALERIAN.

Sex. Syst. Triandria Monogynia.

(Herbæ sylvestris radix, *L.*—Root, *E. D.*)

HISTORY.—The earliest writer who notices this plant is Fuchsius. The φοῦ of Dioscorides (lib. i. cap. x.) is not Valeriana sylvestris, as Hoffman supposed, but *V. Dioscoridis.*[1]

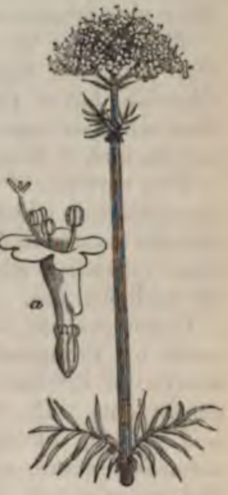
BOTANY. **Gen. Char.**—Limb of the *calyx* involute during flowering, then unrolled into a deciduous pappus, consisting of many plumose setæ. Tube of the *corolla* obconical or cylindrical, equal at the base or gibbous, without a spur; limb obtusely 5-cleft, rarely 3-cleft. *Stamens* 3. *Fruit* indehiscent; when ripe 1-celled, 1-seeded (De Cand.)

Sp. Char.—Leaves all pinnate; leaflets in 7—10 pairs, lanceolate, dentate-serrate or quite entire; stem furrowed; root 1-stalked, stoloniferous. Flowers flesh coloured. Fruit smooth or pubescent (Koch, Syn. Fl. Germ. ed. 2).

Herbaceous, perennial, from 2 to 6 feet high. Root fibrous. Flowers in June.

Hab.—Most countries of Europe.

FIG. 6.



Valeriana Officinalis.

This species is subject to variation.

α. *major*, Koch; latifolia, Hayne; V. palustris major, C. Bauhin; Larger, Broad-leaved or Taller Common Valerian. —Stem taller; leaflets broader, all toothed.—Grows in moist localities, as ditches, marshes, and the banks of pools and rivers.

β. *minor*, Koch; angustifolia, Hayne; V. angustifolia Tausch, De Cand.; V. officinalis var. β, Smith, Engl. Bot. vol. i. p. 43, 1824; V. officinalis var. α, foliis angustioribus, Woodville, Med. Bot. t. 96; V. sylvestris major montana, C. Bauhin; Smaller, Narrow-leaved, or Mountain Common Valerian — Stem shorter, leaflets narrower (linear-lanceolate), entire, or the lower ones few toothed. —Grows on dry heaths and elevated pastures. — Roots more odorous, and, therefore, to be preferred for medicinal use.

COLLECTION.—The valerian root of the shops is collected about August and September from both wild and cultivated plants. I am informed that the roots of the wild sort are now gathered chiefly in Hampshire; but Hill[2] states that, in his time, the heaths of Kent and Essex furnished a great deal of it.

The cultivation of valerian is carried on at Ashover, near Chesterfield, in Derbyshire. The plants are either procured from the offsets of former plantations, or from wild plants found in wet places in the neighbouring woods. Soon after the plant "comes up in the Spring the tops are cut off, to prevent its running to seed, which spoils it. At Michaelmas, the leaves are pulled and given to cattle, and the roots dug up carefully, and clean washed, and the remaining top is then cut close off, and the thickest part slit down to facilitate their drying, which is effected on a kiln, after which they must be packed tight, and kept very dry, or they spoil. The usual produce is about 18 cwt. per acre."[1]

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[1] Smith, *Prodr. Fl. Græcæ*, vol. i. p. 21; and Fraas, *Synops. Plant. Fl. Classicæ*, p. 217, 1845.

[2] *History of the Materia Medica*, p. 581, 1751.

DESCRIPTION.—The root (*radix valerianæ*) consists of a short tuberculated, underground stem or rhizome, from which issue one or more creeping shoots or stoles, and numerous round tapering root-fibres, which are from 2 to 6 inches long, whitish internally, and, when fresh, greyish or yellowish white externally, but when dried, yellowish brown. They give origin to fibrillæ or rootlets.

The taste of the root is warm, camphoraceous, slightly bitter, somewhat acrid, and nauseous. The odour of the fresh roots is not very considerable, but of the dry, especially when they have been kept for some time, much stronger: it is fetid, very characteristic, and highly attractive to cats, and, it is said, to rats also.

Two varieties of valerian root are found in English commerce: viz. the *cultivated*, which being finer looking, is usually kept by druggists; and the *uncultivated*, or *wild sort* (*herbæ sylvestris radix*, L.; *radix valerianæ sylvestris*), which is more fragrant, and, therefore, to be preferred for medicinal use.

COMPOSITION.—In 1809, a quantitative analysis of this root was made by Trommsdorff;[2] and in 1834 this chemist made a second analysis of it,[3] but he did not determine the relative proportion of the constituents. He found *a peculiar volatile oil* combined with *valerianic acid, starch, albumen, peculiar extractive matter* (*valerianin*), *yellow extractive matter, soft or balsamic resin, mucilage, valerianate of potash, malates of potash and lime, sulphate and phosphate of lime, silica,* and *woody fibre.* The ligneous matter constitutes, on an average, about five-eighths of the whole. Of the soluble constituents the valerianin is the most abundant, and next to this the mucilage. The balsamic resin amounts to about half the weight of the valerianin.

1. VOLATILE OIL OF VALERIAN (*Oleum Valerianæ*).—According to Huralt,[4] this oil does not exist ready-formed in valerian root, but is produced only by the action of water; for pure ether does not extract any volatile oil from the root. When the root is submitted to distillation with water, the distillate consists of water, on which the oil floats. Martius obtained three ounces of oil from twelve pounds of the dried root, and Bartels eleven ounces from fifty pounds of root.

Crude oil of Valerian is a mixture of at least five substances, whose relative proportions vary with the age and mode of preservation of the oil. Of these five substances, two are volatile oils, and may be regarded as the essential components of the oil. The more volatile of these is *borneen*, $C^{20}H^{16}$, a colourless liquid identical with a carbohydrogen obtained from Borneo camphor. In odour it resembles oil of turpentine, with which it is isomeric. The less volatile ingredient is *valerol*, $C^{12}H^{10}O^{2}$, which is lighter than water, has an odour of hay, and by exposure to the air absorbs oxygen and yields valerianic acid. The three non-essential constituents of the oil are *valerianic acid*, a *resin*, and a kind of *camphor* or solid volatile oil.[5]

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[1] *Encyclop. of Agriculture*, pp. 945 and 1152.

[2] Trommsdorff's *Journal d. Pharm.* xviii. 1809; *Bulletin d. Pharmacie*, t. i. p. 209, 1809.

[3] *Ann. der Pharm.* Bd. x.; also *Pharm. Central-Blatt für* 1834, S. 742.

[4] *Journ. de Pharm. et de Chim.* t. xii. p. 69, 1847.

[5] Gerhardt, *Ann. d. Chem. u. Pharm.* Bd. xlv. S. 29, 1843.

Fresh prepared and rectified oil of valerian is neutral, clear, with an odour which is not disagreeable. By exposure to the air it resinifies, becomes coloured, thick, acid (owing to the formation of valerianic acid), and acquires a more disagreeable odour.

Oil of valerian has been used in medicine, as a powerful stimulant and antispasmodic, in doses of one or two or more drops.

2. VALERIANIC or VALERIC ACID (*Acidum Valerianicum.*) $C^{10}H^{9}O^{3},HO$.—It is considered by some to be identical with phocenic acid obtained by Chevreul from whale oil. It can be procured from valerian root and the fruit of Viburnum Opulus, in both of which, according to some persons, it pre-exists. But in valerian root it is probably formed by the oxidation of valerol. When this root is submitted to distillation with water, the distillate usually contains valerianic acid. Rabourdin,[1] by previously acidulating the water with sulphuric acid, obtained 231 grains of valerianic acid from 4⅖ lbs. of the root; whereas, when simple water was employed, the product was only 77 grains of acid. By Rabourdin's process, Aschoff[2] procured 18⅜ drachms of acid from 15 lbs. of root. Lefort[3] advises that, prior to distillation, the coarsely powdered root should be macerated in water mixed with sulphuric acid and bichromate of potash, in order to promote the oxidation of the valerol, and thereby to increase the product of valerianic acid. He obtained by this method from 262 to 285 grains of valerianate of zinc from 2⅕ lbs. avoirdupoise of the root. By boiling the root in a solution of carbonate of soda, and decomposing the saline solution by sulphuric acid, the Messrs. Smith[4] procured four scruples of acid from a pound of root. Thirault[5] is of opinion that caustic alkali is preferable to the carbonate.

But valerianic acid is a product of the decomposition of various animal and vegetable substances, and is most economically obtained, for commercial purposes, from oil of grain (*fusel oil*). (See *Sodæ valerianas*, Ph. Dubl. p. 1583.)

Valerianic acid is a colourless limpid liquid. Its odour is strong, and somewhat allied to, though distinct from, that of valerian root: its taste is acrid. Its density, at 60° F., is 0·937. It boils at 347° F. It is very slightly soluble in water, with which it forms a hydrate, $C^{10}H^{9}O^{3}, 3HO$; but is soluble in all proportions in alcohol and in ether. With the exception of the valerianates of silver and the protoxide of mercury, all the valerianates are soluble in water.[6]

[M. Gerhardt has obtained anhydrous valerianic acid, as a colourless, slightly odorous, oily fluid, lighter than water, boiling at 419°.]—ED.[7]

3. VALERIANIN; *Peculiar Extractive Matter.*—A yellowish-brown substance, which tastes at first sweetish, afterwards slightly bitter. It is soluble in water, but is insoluble in both absolute alcohol and pure ether. Neither sesquichloride of iron nor acetate of lead produces any change in the aqueous solution.

4. YELLOW EXTRACTIVE MATTER.—Bitterish, soluble in water. The sesquichloride of iron causes a green precipitate, and acetate of lead a dirty yellow precipitate, in the aqueous solution.

5. RESIN.—Insoluble in water, but soluble in alcohol, ether, and oil of turpentine. The alcoholic solution does not redden litmus, nor yield any precipitate on the addition of an alcoholic solution of either acetate of lead or acetate of copper.

PHYSIOLOGICAL EFFECTS.—Valerian excites the cerebro-spinal system. Large doses cause headache, mental excitement, visual illusions (scintillation, flashes of light, &c.), giddiness, restlessness, agitation, and even spasmodic movements. Barbier[8] says that a patient in the Hôtel-Dieu d'Amiens, who took six drachms of the root daily, in the form of decoction, awoke up suddenly out of his sleep, and fancied he saw one side of the room on fire. Its operation on the nervous system is also evin by its occasional therapeutic influence over certain morbid states of t system; whence it has been denominated *nervine* (*nervino-alterative*) a *antispasmodic.* Furthermore, it intoxicates cats (who are very fond of Under its influence these animals roll themselves on the ground in "o rageous playfulness," and are violently agitated. However, the befo mentioned effects of valerian on the nervous system of man are by no me constant; whence practitioners have lost confidence in it as a reme agent. "Yet I have met with some," observes Dr. Heberden,[1] "whon threw into such agitations and hurries of spirits, as plainly showed tha is by no means inert." More inconstant still are its effects on the fu tions of organic life. For while in some cases it has accelerated the pu augmented the heat of the body, and promoted the secretions,[2] in oth it has failed to produce these effects.[3] Large doses often create nause

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[1] *Journ. de Pharm. et de Chimie*, 3me Sér. t. vi. p. 310, 1844.

[2] *Pharmaceutisches Central-Blatt für* 1847, p. 281.

[3] *Journ. de Pharm. et de Chimie*, 3me Sér. t. x. p. 194, 1846.

[4] *Pharmaceutical Journal*, vol. v. p. 110, 1845.

[5] *Journ. de Pharm. et de Chimie*, 3me Sér. t. xii. p. 161, 1847.

[6] For the mode of separating valerianic from butyric and acetic acids, see Liebig, *Chemical Gazette*, vol. viii. p. 24, 1850.

[7] *Pharm. Journal*, vol. xiii. p. 72.

[8] *Mat. Méd.* 2de éd. ii. 83.

USES.—Valerian may be employed as a nervous excitant, and, wh stimulants are admissible, as an antispasmodic. It was formerly in gr repute. It has been principally celebrated in *epilepsy.* It came into in modern times through the recommendation of Fabius Columna, w reported himself cured by it, though it appears he suffered a relaps Its employment has found numerous advocates and opponents;[5] but the present time most practitioners regard it as a medicine of very lit power. In the few cases in which I have employed it, it has failed give the least relief. In some of the milder and more recent forms the disease, neither dependent on any lesion within the cranium nor companied with plethora, as in hysterical epilepsy, it may occasiona prove serviceable. In *chorea,* and other spasmodic affections, it has be used with variable success. I have found temporary benefit from its in females affected with *hypochondriasis* and *hysteria.* Of its use a nervous stimulant in the low forms of *fever,* we have but little experie in this country. In Germany, where it is more esteemed, its employm in these cases is spoken highly of.[6]

ADMINISTRATION.—The dose of the *powder* is from ℈j. to ʒj., even ʒij. Though objected to by some, on account of the quantity inert woody fibre which it contains, it is, when well and recently prepar an efficacious form for administration.

1. INFUSUM VALERIANÆ, L. D.; *Infusion of Valerian.* (Valer Root, bruised, ℥ss. [ʒij. *D.*]; Boiling [distilled, *L.*] Water, Oj. [℥ *D.*] Macerate for half an hour [an hour, *D.*] in a covered vessel, a strain.)—This infusion contains a small quantity of volatile oil, so valerianate of potash (Trommsdorff), and extractive matter, but no res —Dose, f℥j. to f℥ij. This preparation is somewhat less apt to disturb stomach than the powder.

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[1] *Comment.* ch. 69.

[2] See Carminati *Opusc. Ther.* i. 238; Jörg, *Journ. de Chim. Méd.* vii. 275-6.

[3] Trousseau and Pidoux, *Traité de Thérap.* i. 1 and 2.

[4] Murray, *App. Med.* i. 275.

[5] See Copland's *Dict. of Med.* i. 808.

[6] Richter, *Ausf. Arzneimittel.* iii. 23; Sundelin, *Heilmittell,* ii. 126.

2. **TINCTURA VALERIANÆ,** *Tincture of Valerian*, L. E. D. (Valerian, bruised, ℥v.; Proof Spirit, Oij. Macerate for seven [fourteen, *D.*] days, then express and strain, *L. D.* "Proceed by percolation or digestion, as for tincture of cinchona," *E.*)—Dose, fʒj. to fʒiv.—This preparation contains a portion of volatile oil, some valerianate of potash, valerianin, and resin. It possesses the virtues of valerian, but is scarcely sufficiently strong to produce the full effects of the root, without giving it in doses so large as to be objectionable, on account of the spirit contained therein.

3. **TINCTURA VALERIANÆ COMPOSITA,** L., *Tinctura Valerianæ ammoniata*, E.; *Ammoniated Tincture of Valerian.* Valerian, bruised, ℥v.; Aromatic Spirit of Ammonia [Spirit of Ammonia, *E.*], Oij. Macerate for seven days, then express and strain, *L.* "Proceed by percolation or by digestion in a well-closed vessel, as directed for tincture of cinchona," *E.*)—Dose, fʒss. to fʒj. The stimulant influence of the valerian is greatly increased, and its therapeutical efficacy oftentimes augmented, by the ammonia in this preparation.

[4. **EXTRACTUM VALERIANÆ FLUIDUM,** U. S., *Fluid Extract of Valerian.* Take of Valerian in coarse powder, ℥viij; Ether, ℥iv.; Alcohol, ℥xij.; Diluted Alcohol a sufficient quantity. Mix the ether and alcohol, and having incorporated the valerian with one half of the mixture, introduce the mass into a percolator, and gradually pour in the remainder: then add diluted alcohol until the whole liquid which has passed shall amount to a pint. Put the ethereal liquid thus obtained into a shallow vessel, and allow it to evaporate spontaneously until reduced to ℥v. Upon the mass in the percolator pour gradually diluted alcohol, until ℥x. of tincture have passed. With this mix the v. left after the spontaneous evaporation, taking care to dissolve in a little alcohol any old resinous matter which may have been deposited, and add it to the rest. Allow the mixture to stand, with occasional agitation, for four hours, and then filter. The resulting fluid extract should measure a pint, and if it be less than that quantity, the deficiency should be supplied by the addition of alcohol. From its concentration this is an excellent preparation. Dose ♏xx. to xl. in a little water.—ED.]

5. **SODÆ VALERIANAS,** D.; *Valerianate of Soda.* (Take of Bichromate of potash, reduced to powder, ℥ix.; Fusel Oil, f℥iv.; Oil of Vitriol of commerce, f℥viss.; Water, Cong. ss.; Solution of Caustic Soda, Oj., or as much as is sufficient. Dilute the oil of vitriol with ten ounces, and dissolve with the aid of heat the bichromate of potash, in the remainder of the water. When both solutions have cooled down to nearly the temperature of the atmosphere, place them in a matrass, and, having added the fusel oil, mix well by repeated shaking, until the temperature of the mixture, which first rises to about 150°, has fallen to 80° or 90°. The matrass having been now connected with a condenser, heat is to be applied so as to distil over about half a gallon of liquid. Let this, when exactly saturated with the solution of caustic soda, be separated from a little oil that floats on its surface, and evaporated down until, the escape of aqueous vapour having entirely ceased, the

residual salt is partially liquefied. The heat should now be withdrawn; and when the valerianate of soda has concreted, it is, while still warm, to be divided into fragments, and preserved in a well-stopped bottle, *D.*)—Fusel oil, also called oil of grain or amylic alcohol (*alcohol amylicum*, Ph. Dubl.), is transformed, under oxidising influences, into valerianic acid and water.

$$\underbrace{C^{10}H^{12}O^{2}}_{\text{Fusel oil.}} + \underbrace{O^{4}}_{\text{Oxygen.}} = \underbrace{C^{10}H^{9}O^{3},HO}_{\text{Valerianic acid.}} + \underbrace{2HO}_{\text{Water.}}$$

In the process of the Pharmacopœia the oxygen is derived from the chromic acid of the bichromate of potash. When this salt is subjected to the action of sulphuric acid, the products are—oxygen (which is eliminated), water, and potassio-sulphate of chromium.

$$\underbrace{KO,2CrO^{3}}_{\substack{\text{Bichromate}\\ \text{of potash.}}} + \underbrace{4(HO,SO^{3})}_{\text{Oil of vitriol.}} = \underbrace{(KO,SO^{3}+Cr^{2}O^{3},SO^{3})}_{\substack{\text{Potassio-sulphate of}\\ \text{chromium.}}} + \underbrace{4HO}_{\text{Water.}} + \underbrace{3O}_{\text{Oxygen.}}$$

The valerianic acid, being volatile, distils over, and is neutralised by caustic soda. The solution of valerianate of soda is then to be evaporated to dryness, and the residual salt partially liquefied to obtain it in the anhydrous state.

Valerianate of soda ($NaO, \overline{Va}$) crystallises with difficulty, but may be obtained in a cauliflower-like mass. It begins to fuse at 268°, and on cooling forms a white solid mass, which has a greasy or soapy feel. Its odour resembles that of the acid: its taste is sweet, but nauseous. It is deliquescent, and soluble in both water and alcohol. Heated in a platinum capsule, it first fuses, then decomposes, evolves a vapour which burns with a yellow flame, and leaves a residue of carbonate of soda. If to an aqueous solution of the valerianate of soda, hydrochloric acid be added, the valerianic acid is set free, and floats on the solution.

Valerianate of soda is used for the preparation of other valerianates; as those of iron, quinine, and zinc.

6. **ZINCI VALERIANAS**, D.; *Valerianate of Zinc.* (Take of Valerianate of Soda, ℥iiss.; Sulphate of Zinc, ℥ij. and ʒvij.; Distilled Water, Oij. Dissolve the valerianate of soda in one-half, and the sulphate of zinc in the remaining half of the water, and, having raised both solutions to 200°, mix them, and skim off the crystals which are produced. Let the solution be now evaporated at a temperature not exceeding 200°, until it is reduced to the bulk of four ounces, removing, as before, the crystals from the surface, in proportion as they form, and placing them with those already obtained. The salt thus procured is to be steeped for an hour in as much cold water as is just sufficient to cover it, and then transferred to a paper filter, on which it is to be first drained, and then dried at a heat not exceeding 100°.)—By the mutual action of valerianate of soda and sulphate of zinc, we obtain sulphate of soda and valerianate of zinc: the former salt remains in solution, while the latter separates and floats on the solution. Prepared in this way, valerianate of zinc is anhydrous, and its composition is represented by the formula

$ZnO,\overline{Va}$. [It is soluble in 160 parts of water: and 100 parts of the salt consist of 30·35 oxide of zinc and of 69·65 valerianic acid.—ED.] But if valerianate of zinc be prepared by stirring carbonate of zinc with so little water as to form a paste, and adding the calculated quantity of valerianic acid, we obtain a hydrated salt whose composition is $ZnO,\overline{Va},12HO$.[1]

The anhydrous salt crystallises in snow-white, pearly plates, like boracic acid. It has a faint odour of valerianic acid, and a metallic astringent taste combined with that of the acid. It dissolves in 160 parts of cold water, and in 60 parts of alcohol. The solutions have an acid reaction, become turbid on the application of heat, but become again clear on cooling. Cold ether takes up only $\frac{1}{500}$th, boiling ether $\frac{1}{20}$th, of the salt.[2] The hydrated salt is more soluble, and requires only 44 parts of water to dissolve it.

Valerianate of zinc is subject to adulteration. According to Laroque and Huraut,[3] butyrate of zinc is sometimes substituted for it. To detect this, add sulphuric acid, and subject the mixture to distillation to separate the volatile acid. If this be butyric acid, it immediately causes a bluish white precipitate when added to a concentrated solution of acetate of copper: whereas, valerianic acid causes no precipitate; but, on shaking it with the solution, it gives rise to some oily drops of anhydrous valerianate of copper. Another fraud consists in substituting acetate of zinc flavoured with oil of valerian. This may be distinguished by its odour, and by its yielding acetic ether (recognised by its odour), when mixed with a little proof spirit and one-fourth the volume of oil of vitriol.[4]

This salt was first introduced into medicinal use by Prince Louis Lucien Bonaparte.[5] Its physiological effects are not very obvious: they have been assumed, however, to combine those of valerian and zinc. But, before this is admitted, it must be shown that valerianic acid is the essential active ingredient of valerian, which I do not believe to be the case. Dr. Devoy[6] states that, in doses of 2½ grains, it produces a little headache, slight vertigo, and some confusion of hearing.

Valerianate of zinc has been employed in medicine as an antispasmodic, chiefly in neuralgia, but also in some other neuroses,— as epilepsy. It is reported to have produced beneficial results; but, although I have repeatedly employed it, I am unable to report favourably of its effects.[7]

The dose of it is from one to six or more grains. It may be administered either in the form of pill, or dissolved in water. As a topical astringent and sedative, it has been employed in chronic conjunctivitis, in the form of collyrium, prepared by dissolving from 2 to 4 grains of the salt in two ounces of distilled water.

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[1] Wittstein, *Buchner's Repertorium*, 3tte Reihe, Bd. i. S. 189, 1848.

[2] *Ibid.* 2ter Reihe, Bd. xxxvii. S. 302, 1845.

[3] *Chemical Gazette*, vol. iv. p. 302, 1846.

[4] *Pharmaceutical Journal*, vol. viii. p. 577, 1849.

[5] *Journ. de Chim. Méd.* t. ix. 2de sér. p. 336, 1843; and *Pharm. Journ.* vol. iv. p. 131, 1844.

[6] *Journ. de Pharm.* 3me sér. p. 141, 1844; and *Chemical Gazette*, vol. ii. p. 469, 1844.

[7] For further details and references, see Dierbach, *Die neuest. Entdeck. in d. Mat. Med.* Bd. iii. S. 486, 1845; Aschenbrenner, *Die neueren Arzneim.* 1848; and Dunglison's *New Remedies*, 6th edit. p. 699, 1851

7. **FERRI VALERIANAS**, D.; *Valerianate of the Sesquioxide of Iron; Valerianate of Iron.* (Take of Valerianate of Soda, ℥v. and ʒiij.; Sulphate of Iron, ℥iv.; Distilled Water, Oj. Let the sulphate of iron be converted into a persulphate, as directed in the formula for *Ferri Peroxydum Hydratum*, and, by the addition of distilled water, let the solution of the persulphate be augmented to the bulk of eight ounces. Dissolve the valerianate of soda in ten ounces of the water, then mix the two solutions cold, and, having placed the precipitate which forms, upon a filter, and washed it with the remainder of the water, let it be dried by placing it for some days rolled up in bibulous paper on a porous brick. This preparation should be kept in a well-stopped bottle.)—When valerianate of soda and sulphate of the sesquioxide of iron are mixed, double decomposition ensues, sulphate of soda is formed in solution, and valerianate of the sesquioxide of iron (*Ferri Valerianas*, D.) is precipitated.

According to Wittstein,[1] the formula for valerianate of iron is $3Fe^2O^3,7\overline{Va},2HO$ or $7(Fe^2O^3,\overline{3Va})+2(Fe^2O^3,3HO.)$ The valerianate of iron precipitated in the cold is, therefore, a basic salt, the two equivalents of acid required to produce a neutral salt being replaced by two equivalents of water. If the valerianate be prepared with warm solutions, its composition, according to Rieckher,[2] is $4Fe^2O^3,9\overline{Va}$, without regarding the water, which he considers as hygroscopic.

Valerianate of iron, prepared according to the Dublin College, is a tile-red loose amorphous powder with a faint odour and taste of valerianic acid. When heated it first fuses, then evolves its acid, and is converted into sesquioxide of iron. At a temperature of 212° it gives out part of its acid. It is nearly insoluble in water: it does not intermix well with cold water, but repels it like lycopodium; and boiling water gradually extracts the acid from it. It dissolves in acids and in alcohol.

Various adulterations are said to be practised with it. Citrate and tartrate of iron, flavoured with a few drops of oil of valerian, have been extensively sold: but these substitutes are soluble in water and insoluble in spirit. Another substitute is in the form of a brown powder soluble in water and in spirit. It smells of valerianic acid, but on being decomposed with hydrochloric acid or sulphuric acid, yields no appreciable quantity of the oily product.[3]

The valerianate of iron which I have found in the most respectable shops in London is only partially soluble in alcohol. It does not dissolve in water, but when gently heated with hydrochloric acid dissolves and evolves a considerable quantity of valerianic acid which floats on the solution.

It is but little employed in medicine; nor is it probable that it will come into use, on account of its insolubility in water, its disagreeable odour, and its liability to adulteration. It possesses the medicinal qualities of the sesquioxide of iron and valerianic acid combined. It may be used in chlorosis or anæmia complicated with hysteria. The dose of it is from two to four grains in the form of pill.

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[1] *Chemical Gazette*, vol. iii. p. 327, 1845. See also Wittstein's second analysis *Pharm. Central-Blatt für* 1848, S. 732.

[2] *Jahresbericht über d. Fortschritte in d. Pharm. in allen Land. im Jahre* 1848, S. 100; and Liebig and Kopp's *Annual Report*, vol. i. 1847-48, p. 429.

[3] *Pharmaceutical Journal*, vol. viii. pp. 577-579.

8. **QUINÆ VALERIANAS**, D.; *Valerianate of Quinine.*—(Take of Muriate of Quina, ʒ vij.; Valerianate of Soda, gr. clxxiv.; Distilled Water, ℥xvj. Dissolve the valerianate of soda in two ounces, and the muriate of quina in the remainder of the water, and, the temperature of each solution being raised to 120°, but not higher, let them be mixed, and let the mixture be set by for four-and-twenty hours, when the valerianate of quina will have become a mass of silky acicular crystals. Let these be pressed between folds of blotting paper, and dried without the application of artificial heat. Instead of weighing out seven drachms of muriate of quina, and dissolving it in water, as is above prescribed, we may employ the solution of the muriate prepared from an ounce of the sulphate as directed in the formula for *Quinæ Murias*, such solution having been first evaporated to fourteen ounces. It may be observed here, that should it become necessary to evaporate a liquid containing valerianate of quina, care must be taken that its temperature does not rise higher than 120°.)—By the mutual action of the hydrochlorate or muriate of quinine and of the valerianate of soda we obtain, by double decomposition, chloride of sodium and valerianate of quinine: the last mentioned salt separates as a crystalline form.

$$\overset{+}{Q}{}^2HCl+NaO,\overline{Va}=\dot{N}aCl+\overset{+}{Q}{}^2\overline{Va}+HO.$$

Valerianate of quinine crystallises in colourless rhomboidal tablets with a slight mother-of-pearl lustre, or in white opaque radiately grouped needles. $\overset{+}{Q}{}^2\overline{Va}24HO$. It has a faint odour of valerianic acid and a bitter taste. It dissolves in 110 parts of cold, and in 40 parts of boiling water; in 6 parts of cold, and in equal parts of boiling alcohol, of sp. gr. 0·863; and likewise in ether. All the solutions are neutral.

There is also an amorphous resinous-looking valerianate of quinine, obtained by concentrating the solution at a temperature above 122°; and which is scarcely soluble in water. Its composition, according to Wittstein,[1] is $\overset{+}{Q}{}^2\overline{Va}4HO$.

A spurious valerianate of quinine has been met with in commerce. It consists of the disulphate of quinine to which a few drops of oil of valerian have been added to disguise it.[2] When added to water this yields a thin film of oil. It dissolves in about 30 parts of boiling water; and as the solution cools it deposits the well-known crystals of disulphate of quinine.

Valerianate of quinine was first prepared by Prince Louis Lucien Bonaparte,[3] who tried it on some of the inhabitants of the marshy region, la Maremma, of Rome, and found that it produced less disorder of the nervous system than sulphate of quinine. It has also been employed by Devay,[4] Castiglioni,[5] and others, as an antiperiodic and an antispasmodic in intermittent and remittent diseases, especially intermittent neuralgia.

It may be administered in doses of from one to three or four grains, either in the form of pill, or in that of a mucilaginous mixture. If given in the latter form it must be remembered that it is readily decomposed by acids. Dissolved in sixty parts of oil it has been used as a liniment rubbed over the region of the spleen.

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[1] *Chemical Gazette*, vol. iii. p. 326, 1845.

[2] *Pharm. Journ.* vol. viii. p. 577, 1849.

[3] *Journ. de Chim. Méd.* t. viii. 2de sér. pp. 518–673, 1842; also *Pharmaceutical Journal*, vol. iv. p. 130, 1844.

[4] *Pharm. Journ.* vol. iv. p. 430, 1844.

[5] Quoted by Bouchardat, *Ann. de Thérapeutique* pour 1845.

[The other officinal plants of the order Valerianaceæ are:—

1st. *Valeriana Altea.*—Altea Nard, which grows on the alps of Piedmont, and also in Istria. This plant, and the Valeriana Salinicula, yield the medicine called *Spica narde,* vulgarly *Spikenard,* used by the inhabitants of those regions as a perfume, and to keep off insects. The root is the portion chiefly employed. It is also used in hysteria and epilepsy.

Nardostachys Jatamansi, De Candolle.—This is stated by Lindley to be the true *Spikenard.* It is used as a perfume in the East, also in epilepsy.—ED.]

ORDER LVI. RUBIACEÆ, *Jussieu.*

CINCHONACEÆ and GALIACEÆ, *Lindley.*

CHARACTERS.—Tube of the *calyx* adherent to the ovary; limb various, truncated or many-lobed, frequently regular; the lobes as many as those of the corolla, rarely intermixed with accessory teeth. *Corolla* gamopetalous, inserted into the top of the tube of the calyx; lobes usually 4 to 5, rarely 3 to 8; contorted or valvate in æstivation. *Stamens* as many as, and alternate with, the lobes of the corolla; more or less adnate to the tube of the corolla; *anthers* oval, bilocular, turned inwards. *Ovarium* within the calyx to which it coheres, usually 2- or many-celled, rarely by abortion 1-celled, crowned with a fleshy urceolus, from which a single *style* arises. *Stigmas* usually 2, distinct, or more or less coherent, rarely many, distinct, or coherent. *Fruit* baccate, capsular, or drupaceous, 1- or many celled; the cells 1-, 2-, or many-seeded. *Seeds* in the 1-seeded cells attached to the apex, or usually at the base; in the many-seeded ones, connected with a central placenta, usually horizontal: *albumen* horny or fleshy, large: *embryo* straight, or somewhat curved, in the midst of albumen; the *radicle* terete, turned to the hilum; the *cotyledons* foliaceous (De Cand.)—*Trees, shrubs,* or more rarely *herbs. Leaves* simple, quite entire, opposite, or rarely verticillate, with stipules. *Flowers* arranged variously, rarely unisexual by abortion.

PROPERTIES.—The *roots* often abound in colouring matter, and hence are used in dyeing; as some of those belonging to the genera *Rubia, Gardenia, Hedyotis, Genipa, Galium, Asperula, Palicourea, Oldenlandia,* &c. Many roots possess emetic properties, as those of *Cephaëlis, Psychotria, Richardsonia, Spermacoce, Manettia, Chiococca,* &c.

The *barks* are often bitter, astringent, and somewhat aromatic; and are eminently distinguished for their tonic, febrifuge, and antiperiodic qualities, as those of *Cinchona, Exostema, Coutarea, Cosmibuena, Remija, Hymenodictyon, Pinkneya,* &c.

The important use of the torrefied *albumen* of *Coffea arabica* is well known. It is probable that the albumen of other species possesses analogous properties: that of *Psychotria herbacea* has been used for similar purposes.

Sub-order I. COFFEACEÆ, *Endl.*

CHARACTERS.—*Ovules* solitary, or very rarely 2 in each cell. *Fruit* with 1, very rarely 2, seeds in each cell.

234. Rubia tinctorum, *Linn.*—Dyer's Madder.

Sex. Syst. Tetrandria Monogynia.

(Radix.)

Ἐρυθρόδανον, Hippocrates, de Morb. Mul. lib. 1, &c.; *τό σπαρτόν ἐρυθρόδανον,* Dioscorides, lib. iii. cap. 160; *Rubia,* Pliny, lib. xix. cap. 17; and lib. xxiv. cap. 56. According to Beckmann (Hist. of Invent. and Discoveries, vol. iii. p. 275), it was called

Varantia in the middle ages.— An herbaceous plant.— *Root* perennial, horizontal, long, crouching, reddish brown. *Stems* several, herbaceous, tetragonal, with hooked prickles. *Leaves* somewhat membranous. *Flowers* small, yellow. *Berries* dark purple. A native of the Levant and south of Europe: cultivated in France, Holland, &c. for the sake of the roots. — The variety β *Iberica* is said to yield the best roots for tinctorial purposes.

Madder roots (*radix rubiæ tinctorum*) are long, cylindrical, about the thickness of a writing quill, branched, externally deep reddish brown. They consist of a dark easily separable cortex, whose epidermis is thin, and of a ligneous meditullium, which in the fresh state is yellow, but by drying becomes reddish. The odour of the root is feeble; the taste is bitter and astringent. The microscope discovers abundance of needle-shaped crystals (*raphides*) in the cells of the cortex of the root.

In commerce madder occurs in two forms,— in the entire root, and in the ground or pulverised state.

1. The name of *lizari* or *alizari*[1] is applied to the entire roots. The sort which is usually found in English commerce is the *Levant*, *Turkey*, or *Smyrna Madder*. It is cultivated in Greece and Turkey. Petter states that the best sort is that obtained from *Rubia peregrina* (which is by some regarded as a mere variety of *R. tinctorum*). In France, the *lizari of Avignon* is the kind usually found in the markets. *East India madder* or *munjeet* is the produce of *Rubia Munjista*, Roxb.

2. Ground or prepared madder, called in France *garance*, is imported from Holland and France. *Dutch* or *Zealand madder* is of four kinds, viz. *crops* (the best), *ombro*, *gamene*, and *mull* (the worst). *Alsatian madder* has replaced the Dutch sort in French manufactories. It is manufactured at Strasburgh, Hagenau, and Geisselbrunn. *Avignon madder* is the kind most generally used in France.[2]

Small quantities of *Spanish Madder* are imported.

The powdered madders are subject to adulteration. The substances employed for this purpose are mineral or vegetable. The mineral substances are brick-dust, ochre, sand, and argillaceous earths. The vegetable substances are saw-dust, bran, almond shells, &c. To determine the tinctorial value of commercial madders, Labillardière used a colorimeter. Others have determined it by dyeing; and some by the quantity of the colouring principle. (For details the reader is referred to Girardin's paper before quoted.)

Madder root has been analysed by Bucholz,[3] by John,[4] and by Kuhlmann.[5]

Bucholz.	
Resinous red colouring matter	1·2
Extractive ditto	39·0
Reddish brown substance, soluble in potash and hot alcohol	1·9
A pungent extractive	0·6
Gummy matter	9·0
Woody fibre	22·5
Matter soluble in potash	4·6
Vegetable salts of lime, with colouring matter	1·8
Water	12·0
Loss	7·4
Madder root	100·0

Kuhlmann.
Red colouring matter.
Yellow ditto (*Xanthin*).
Mucilage.
Nitrogenous matter.
Bitter substance.
Gum.
Sugar.
Woody fibre.
Vegetable acid.
Porous resin.
Salts in the ashes.
Madder root.

The *colouring matter* of madder has been the subject of repeated investigation. Decaisne[6] has shown that in the living state madder root contains only yellow colouring matter. This is held in solution, and resides not in any peculiar vessels or secretory apparatus, but in the cellular tissue and latex vessels. Nor is it confined to the root, for in the stem of full-grown plants, larger or smaller spots are here and there found, where the cells and spiral vessels are filled with it. As the root becomes older the yellow liquid becomes deeper coloured. By exposure to atmospheric oxygen this yellow liquid becomes red, cloudy, and granular; the granules appearing to be of a gummy-resinous nature, and partly soluble in alcohol.

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[1] The Turkish word *alizari* is derived from ριζάρι, the modern Greek name for madder.

[2] Girardin, *Chemical Gazette*, vol. ii. p. 14, 1844.

[3] Gmelin, *Handb. d. Chem.* ii. 1280.

[4] *Ibid.*

[5] *Ann. Chim. et Phys.* xxiv. 225, 1824.

[6] *Recherches Anatom. et Physiol. sur la Garance*, Bruxelles, 1837. Also, Meyen's *Report on the Progress of Vegetable Physiology during the year* 1837, translated by W. Francis, p. 49, Lond. 1839; and *Journ. de Pharmacie*, t. xxiv. p. 424, 1838.

Several chemists have investigated the nature of the colouring matter of madder: those which deserve to be especially mentioned are Robiquet and Colin,[1] Gaultier de Claubry and Persoz,[2] Runge,[3] Schunck,[4] Debus,[5] Strecker,[6] and Rochleder.[7] The result of their investigation has been the production of several colouring matters, which, if Decaisne's observations be correct, must be derived from a single principle.

Runge states that madder contains two colourless acids (termed respectively *madderic* and *rubiacic* acids) and five colouring matters, which he calls respectively *madder purple*, *madder red*, *madder orange*, *madder yellow* (the *xanthin* of Kuhlmann) and *madder brown*. Of these, however, the two red colouring matters (madder purple and madder red) alone require separate notice.

1. ALIZARINE, Robiquet and Colin; *Red colouring matter*, Claubry and Persoz; *Madder red*, Runge; *Lizaric acid*, Debus. This occurs in two forms, the anhydrous and hydrated. *Anhydrous alizarine* ($C^{20}H^{6}O^{6}$ according to Strecker; $C^{60}H^{19}O^{19}$ according to Rochleder) has a red colour passing more or less into yellow. It fuses and sublimes in orange-coloured needles. It dissolves in boiling water, in alcohol, and in ether. The solutions are yellow. The slightest trace of alkali colours the aqueous solution red. It dissolves in alkaline solutions. The liquid obtained is, if dilute, violet coloured, but if concentrated, blue by reflected, and purple by transmitted light. It is insoluble in a cold solution of alum. It forms a red solution in hydrated sulphuric acid. *Hydrated alizarine* ($C^{20}H^{10}O^{10}$ or $C^{20}H^{6}O^{6}+4aq$) occurs in small scales having the appearance of mosaic gold.

2. PURPURINE, Robiquet and Colin; *Madder-purple*, Runge; *Oxylizaric acid*, Debus. This differs from alizarine chiefly in its solubility in solution of alum: the resulting liquid has a fine bright red colour, — by reflected light an orange colour. *Anhydrous purpurine* ($C^{18}H^{6}O^{6}$) is in the form of red acicular crystals. It dissolves more readily in warm water than alizarine: it is also soluble in alcohol, ether, concentrated sulphuric acid, and potash. Its aqueous, alcoholic, and potash solutions are red: by the colour of its potash solution it may be distinguished from alizarine. *Hydrated purpurine* ($C^{18}H^{7}O^{7}$ or $C^{18}H^{6}O^{6}+1aq$) is in the form of orange-coloured crystals.

The influence of madder over the system is exceedingly slight. Its topical effect is scarcely obvious. Home[8] ascribed to it emmenagogue qualities. Others have declared it to be diuretic. Neither of these effects, however, was observed by Dr. Cullen.[9] It may, perhaps, possess mild astringent and tonic properties.

But the most remarkable physiological effect of madder is that of colouring the bones of animals fed with it, red. This fact was noticed by Belcher;[10] though Beckmann[11] has adduced evidence to prove that some hints of it are to be found in the works of the ancients. This effect on the bones is produced more effectually, and in a much shorter time, in young than in old animals. In birds, the beak and claws became coloured. As the nerves, cartilages, aponeuroses, tendons, and periosteum are not tinged, the effect is ascribed to the chemical affinity of the phosphate of lime for this colouring matter. Mr. Gibson[12] accounts for it as follows: —The blood charged with the red particles imparts its superabundance of them to the phosphate as it circulates through the bones. But as soon as the blood is freed from the madder by excretion, the serum then attracts the colouring matter, and in a little time entirely abstracts it.

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[1] *Ann. Chim. et Phys.* xxxiv. 225, 1827.

[2] *Ibid.* xlviii. 69.

[3] *Records of Science*, ii. 452; and iii. 44 and 135.

[4] *Ann. der Chem. u. Pharm.* Bd. lxvi. S. 174, 1848; also *Chemical Gazette*, vol. vi. p. 347, 1848.

[5] *Chemical Gazette*, vol. vi. p. 437, 1848.

[6] *Quarterly Journal of the Chemical Society of London*, vol. iii. p. 243, 1851; also, Wolff and Strecker, in the *Chemical Gazette*, vol. viii. p. 329, 1850.

[7] *Chemical Gazette*, Jan. 15, 1852.

[8] *Clinical Experiments*, p. 422, 2d edit.

[9] *Mat. Med.*

[10] *Phil. Trans.* vol. xxxix.

[11] *Hist. of Invent. and Discov.* iii. 279.

[12] *Manchester Memoirs*, i. 146, 2d ser.

This hypothesis has, however, been combated by Mr. Paget,[1] who asserts that the madder colours only those particles of phosphate of lime which are deposited during its use, and that it has no influence on the phosphate already existing in the bones before its administration, nor has the serum any chemical power to remove the colour from the phosphate once tinged. The coloured phosphate does indeed regain its whiteness after a time, when the madder is no longer exhibited; but this he ascribes to the "gradual decomposition of the madder, as reddened skeletons gradually lose their colour when exposed to air and light." As, however, living bones are not subjected to the same influence of air and light (powerful decolorizers), which the skeletons referred to are, the analogy does not hold good; and this part of Mr. Paget's hypothesis is, therefore, unsatisfactory.

Tiedemann and Gmelin[2] could not detect the colouring matter of madder in the chyle; and the red tint of the serum prevented them ascertaining its existence in the blood, though of this scarcely a doubt can exist, inasmuch as it has been found in the excretions (for example, urine, milk, and sweat).

It was formerly a favourite remedy in jaundice, in which disease Sydenham used it.[3] On account of its capability of tinging the bones red, it has been recommended in rickets and mollities ossium, on the supposition of its promoting the deposition of bone earth;[4] but this notion appears to be groundless. Home[5] employed it as an emmenagogue in uterine complaints.—The *dose* of it is ʒss. to ʒij. three or four times a day.

235. CEPHAËLIS IPECACUANHA, *Richard.*—THE TRUE IPECACUANHA.

Sex. Syst. Pentandria Monogynia.

(Radix, *L.*—Root, *E. D.*)

HISTORY.—Ipecacuanha is first mentioned by Michael Tristram,[6] who calls it *Igpecaya* or *Pigaya*. In 1684 it was described and figured by Piso.[7] In 1686 it was celebrated in Paris as a remedy for dysentery. It appears that Jean-Adrian Helvetius (then a young man) attended with Afforty, a member of the faculty, a merchant, named Grenier, or Garnier, who, when he recovered from his illness, gave to his physician, as a testimony of his gratitude, some of this root, as a valuable remedy for dysentery. Afforty attached very little importance to it, but gave it to his pupil, Helvetius, who tried it, and thought he had found in it a specific against dysentery. Numerous placards were placed about the streets of Paris, announcing to the public the virtues of the new medicine, which Helvetius sold without discovering its nature. Luckily for him, some of the gentlemen of the court, and even the Dauphin, the son of the king (Louis XIV.), were at this time afflicted with dysentery. Being informed by his minister Colbert of the secret possessed by Helvetius, the king deputed his physician Aquin and his confessor Le P. de Chaise to arrange with Helvetius for the publication of the remedy. 1000 louis-d'or was the price which was paid, after some trials had been made with it at the Hôtel-Dieu, and which were crowned with the most brilliant success. Garnier now put in his claim for a part of the reward, saying that he, properly speaking, was the discoverer of the medicine; but the claim was not allowed. Subsequently Helvetius obtained the first medical honours of France. He wrote a treatise, describing the use of ipecacuanha in diarrhœa and dysentery.[1]

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[1] *Lond. Med. Gaz.* Nov. 15, 1839.

[2] *Vers. u. d. Wegen auf welch Subst.* S. 7.

[3] Sydenham's *Works*, by Dr. Pechey, 4th edit. p. 150, 1705.

[4] *Journ. de Méd.* t. xxxvii. 1772.

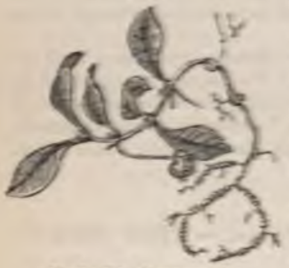
[5] *Clin. Exper.*

[6] Purchas, *Pilgrimes*, fol. vol. iv. 1311.

[7] *Hist. Nat. Brasil.* 101.

Great confusion existed for a long time respecting the plant yielding Ipecacuanha. In 1800, Dr. Gomes returned from the Brazils, and brought with him the plant, on which he published a dissertation. In 1802, Brotero[2] described it under the name of *Callicocca Ipecacuanha*, which Richard[3] afterwards changed to *Cephaëlis Ipecacuanha*.

FIG. 7.



Cephaëlis Ipecacuanha.

BOTANY. **Gen. Char.**—Tube of the *calyx* obviate; limb very short, 5-toothed. *Corolla* somewhat funnel-shaped; its lobes 5, small, rather obtuse. *Anthers* inclosed. *Stigma* bifid, usually exserted. *Berry* obovate-oblong, crowned with the remains of the calyx, 2-celled, 2-seeded (De Cand.)

Sp. Char.—*Stem* ascending, at length erect, somewhat pubescent at the apex. *Leaves* oblong-ovate, rough above, finely pubescent beneath. *Stipules* cleft into setaceous segments. *Heads* terminal, erect, at length pendulous. *Bracts* 4, somewhat cordate (De Cand.)

Root perennial, annulated, simple, or dividing into a few diverging branches, flexuous, from 4 to 6 inches long; when fresh, pale brown externally. *Stem* somewhat shrubby, 2 or 3 feet long, emitting runners. *Leaves* rarely more than 4 or 6, placed at the end of the stem and branches; *petioles* pubescent, which are connected to each other by the erect stipules. *Stipules* membranous at their base. *Peduncles* solitary, erect when in flower, reflexed when in fruit. *Head* semiglobose, 8- to 10-flowered. *Involucre* 1-leafed, spreading, deeply 4- to 6-parted: segments obovate. *Bracts* acute, pubescent; a single one to each flower; *Calyx* minute. *Corolla* white. *Stamens* 5. *Ovary* ovate; *style* filiform, white; *stigmas* linear, spreading. *Berry* soft, fleshy, violet-black. *Seeds* (nucules) pale, plane-convex: *albumen* horny.[4]

Hab.—Brazil; in moist shady situations from 8° to 20° south latitude. Abundant in the valleys of the granitic mountains, which run (more or less distant from the sea) through the provinces of Rio Janeiro, Espirito Santo, and Bahia; also met with in Pernambuco. Humboldt and Bonpland found it on the St. Lucar mountains of New Granada.

COLLECTION OF THE ROOTS.—The roots are gathered at all seasons of the year, though more frequently from January to March inclusive; and as no care is taken in the cultivation of the plant, it has become scarce around the principal towns. Those Brazilian farmers who reside in the neighbourhood of the plant carry on considerable commerce with it. The native Indians also are very assiduous in the collection of it. Those called by the Portuguese the Coroados, who live near the river Xipotó, in the province of Mínaes, as well as their neighbours, the Purí, are the greatest collectors of it. They sometimes leave their villages for two months at a time, fixing their habitations in those places in which this plant abounds. They cut the roots from the stems, dry them in the sun, and pack them in bundles of various sizes and forms.[1]

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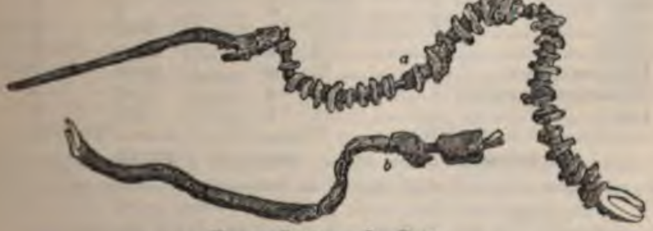
[1] K. Sprengel, *Hist. de la Méd.* t. v. p. 468.
[2] *Trans. of the Linn. Soc.* vol. vi. p. 137.
[3] *Bull. de la Soc. de la Fac. de Méd.* 1818.
[4] Condensed from Martius, *Spec. Mat. Med. Brasil.* p. v. 1824.

Ipecacuanha is imported into this country from Rio Janeiro, in bales, barrels, bags, and serons.

DESCRIPTION.—The root of this plant is the *ipecacuanha* (*radix ipecacuanhæ*) of the shops. No other root is known in English commerce by this name. By continental writers it is denominated *annulated ipecacuanha* (*radix ipecacuanhæ annulatæ*), to distinguish it from the roots of Psychotria emetica and Richardsonia scabra; the first of which is termed striated ipecacuanha—the second, undulated ipecacuanha: both of which will be described hereafter.

The root of Cephaëlis Ipecacuanha occurs in pieces of three or four inches long, and about the size of a small writing-quill: variously bent and contorted; simple or branched. It has a knotty appearance, in consequence of a number of deep circular fissures about a line in depth, and which extend inwardly to a central ligneous cord, so as to give the idea of a number of rings strung upon a thread (hence the name, *annulated*). These rings are unequal in size, both with respect to each other and to different parts of the same ring. This root has a resinous fracture. Its substance consists of two parts: *one* called the *cortical portion*, which is brittle and resinous, of a horny appearance, with a greyish or brownish-grey colour—sometimes whitish; and a *second*, called *meditullium*, and which consists of a thin, yellowish-white, woody, vascular cord, running through the centre of each piece. [Mr. Evans[2] finds that a transverse section of the root presents, first, an epidermis, consisting of compact, irregularly angular cells with thick walls; beneath this are large thin-walled cells readily separable, filled with minute rounded starch grains which present a distinct central hilum with concentric rings. The meditullium consists of thick pitted woody fibre, also containing starch grains. These fibres frequently appear twisted, probably from the contortions produced by decay.—ED.] In 100 parts of good ipecacuanha, there are about 80 of cortex and 20 of meditullium. Ipecacuanha root has an acrid, aromatic, somewhat bitter taste, and a slightly nauseous but peculiar odour. The colour of the root varies somewhat, being brownish, reddish-brown, greyish-brown, or grey.

FIG. 8.



Brown Ipecacuanha Root.
a, Ringed portion. *b*, Portion of a root without rings.

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[1] Martius, *op. cit.* p. 6.
[2] *Pharm. Journal*, vol. xiii. p. 311.

Richard,[1] Mérat,[2] and Guibourt,[3] admit three varieties of annulated ipecacuanha, whose principal distinction is the colour of the epidermis. The age of the root, the nature of the soil, and the mode of drying, are among the different circumstances producing these varieties. Sometimes they are met with in the same bale.

Var. α. BROWN ANNULATED IPECACUANHA, Richard; *Brown Ipecacuanha*, Lemery. (*Radix Ipecacuanhæ annulatæ fuscæ.*)—This is the best kind. The greater part of the ipecacuanha of commerce consists of this variety. Its epidermis is more or less deeply brown, sometimes even blackish; its fracture is grey or brownish, its powder is grey. The cortical appearance has a horny appearance. The root which I have received from Professor Guibourt, as ***blackish grey ipecacuanha***, is somewhat less brown. It is the ***grey*** or ***annulated ipecacuanha*** of Mérat.

I have occasionally found in commerce a ***brown non-annulated*** variety of ipecacuanha (fig. 8 *b*) imported in distinct bales. It consists of slender, cylindrical, often-branched pieces, frequently several inches long, smooth, or slightly warty, but not annulated or moniliform, with a very thin cortex, and a woody meditullium of the usual size, or thicker. These pieces appear to be the subterraneous bases of the stems or runners, and the ends of the roots. Occasionally pieces of the brown annulated ipecacuanha are found attached.

Var. β. RED ANNULATED IPECACUANHA, Richard.—This differs from the preceding by the lighter and reddish colour of its epidermis, by its less powerful odour, and by its want of aromatic taste. Sometimes it has, when broken, the same horny and semi-transparent quality of the brown ipecacuanha, but more frequently it is opaque, dull, and farinaceous; in which case it is generally less active. These differences probably depend on the nature of the soil on which the plant grew. The root which I have received from Professor Guibourt under the name of ***reddish grey ipecacuanha***, is scarcely so red as the pieces which I have met with in English commerce. It is the ***red grey ipecacuanha*** of Lemery and Mérat.

Var. γ. GREY ANNULATED IPECACUANHA, Richard; *White Grey Ipecacuanha*, Mérat; *Greater Annulated Ipecacuanha*, Guibourt.—The colour of this variety is greyish-white. Professor Guibourt has met with it of a reddish-grey colour. Grey ipecacuanha occurs in pieces of larger diameter than either of the foregoing kinds, with fewer, more irregular, and less prominent rings. Guibourt says that of late years considerable quantities of it have arrived unmixed with the ordinary sort, and he therefore thinks that it is a distinct kind coming from a different part of Brazil, and derived from another species of Cephaëlis.

I have found, in English commerce, a grey ipecacuanha, whose roots were not longer than the brown variety, but whose rings were imperfectly developed.

COMPOSITION.—The most important analyses of ipecacuanha are those of Pelletier,[4] Richard and Barruel,[5] Bucholz,[6] and more recently by Willigk.[7]

PELLETIER'S ANALYSES.

	Brown Annulated Ipecacuanha.		Red ditto.
	Cortex.	*Meditullium.*	*Cortex.*
Emetina	16	1·15	14
Odorous fatty matter	2	traces	2
Wax	6	0	0
Gum	10	5·00	16
Starch	42	20·00	18
Ligneous matter	20	66·60	48
Non-emetic extractive	0	2·45	0
Loss	4	4·80	2
Ipecacuanha	100	100·00	100

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[1] *Op. cit.*

[2] *Dict. des Scienc. Méd.* t. xxvi.; and *Dict. Mat. Méd.* iii.

[3] *Hist. des Drog.* tom. iii. p. 79, 4me éd. 1850.

[4] *Journ. de Pharm.* iii. 148.

[5] *Ibid.* vi. 264.

[6] Gmelin, *Handb. der Chem.* ii. 1281.

[7] *Pharmaceutical Journal*, vol. x. p. 608, 1851.

BUCHOLZ'S ANALYSIS.

Emetic extractive [emetina]	4·13
Soft resin	2·43
Wax	0·75
Gum	25·17
Starch	9·00
Woody fibre	10·80
Bitter extractive	10·12
Sugar	2·00
Extractive, gum, and starch, extracted by potash	34·80
Loss	0·80
Ipecacuanha	100·00

WILLIGK'S ANALYSIS.

Fat (small quantity).
Unpleasant smelling volatile oil.
Gum.
Starch.
Pectin.
Emetina.
Ipecacuanha acid.
Woody fibre.

1. ODOROUS FATTY MATTER.— It is extracted from ipecacuanha by ether. It is of a brownish-yellow colour, soluble in alcohol and ether, to both of which it communicates a yellow colour. Its odour is very strong, and similar to that of the essential oil of the horse-radish: it becomes insupportable when heat is applied, but is weak, and analogous to that of the ipecacuanha root, when diluted. The taste is acrid; the specific gravity is greater than that of alcohol.

This fatty matter consists of two substances; 1st, *a very fugacious volatile substance*, which is the odorous principle of ipecacuanha root; 2dly, *a fixed fatty matter* (which some chemists have mistaken, when mixed with emetina, for resin), having little or no odour.

Notwithstanding its strong taste and odour, the fatty matter of this root does not seem to have any effect on the stomach. Given in large doses to animals it had no sensible operation. Caventou took six grains at one time, but experienced no marked effects therefrom. Pelletier and Magendie swallowed some grains of it, and experienced a disagreeable impression on the throat, but it was temporary only.

2. EMETINA.—When first discovered by Pelletier and Magendie, in 1817, it was termed *la matière vomitive*, or *emetine* (from *ἐμέω*, *I vomit*).

Pure emetina is white (when not absolutely pure it has a greyish-yellow tinge), pulverulent, inodorous, with a slight bitter taste; fusible at 122° F.; very slightly soluble in cold, but much more so in hot water; very soluble in alcohol, but scarcely soluble in ether and oils. It dissolves in acids, the acidity of which it does not entirely destroy. The *salts of emetina* are slightly acid, and very crystallisable. They form gummy masses, in some only of which are traces of crystallisation occasionally found. Emetina restores the blue colour of litmus which has been reddened by an acid. I find that the yellowish-white emetina, sold in the shops under the name of pure emetina, is coloured red by nitric acid, the red colour being much deepened on the addition of ammonia. An alcoholic solution of iodine, added to an alcoholic solution of emetina, produces a reddish precipitate (*hydriodate of emetina?*). Tincture of galls copiously precipitates solutions of emetina (*tannate of emetina*). The effect of these reagents on emetina is similar to their effect on morphia; but from this last substance emetina is distinguished by the salts of iron, which produce no change of colour in it.

The following is the composition of emetina:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Dumas and Pelletier.*
Carbon	35	210	65·42	64·57
Hydrogen	25	25	7·79	7·77
Nitrogen	1	14	4·36	4·30
Oxygen	9	72	22·43	22·95
Emetina	1	321	100·00	99·59

The following are stated by Magendie[1] as the effects of *impure* emetina:—From half a grain to two grains, given to cats and dogs, caused at first vomiting, then sleep. In doses of from six to ten grains, vomiting, sleep, and death took place. Dissection showed inflammation of the pulmonary tissues and of the mucous membrane of the alimentary canal, from the cardia to the anus. The same effects (namely vomiting, sleep, and death) were observed when impure emetina was dissolved in water, and injected into the jugular vein, into the pleura, into the anus, or into the muscular tissue.

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[1] *Formulaire*, 95.

On man, a quarter of a grain excited nausea and vomiting; a grain and a half, or two grains, taken fasting, caused continued vomiting and decided disposition to sleep.

The effects of *pure* emetina are similar, but more energetic. In one case $\frac{1}{16}$ of a grain caused vomiting in a man eighty-five years of age: two grains are sufficient to kill a dog.

Emetina has been proposed as a remedial agent, as a substitute for ipecacuanha, all the advantages of which it is said to possess in a much smaller dose, and without the unpleasant taste and odour which the root is known to have. I confess, however, I think very little advantage is likely to be gained by the substitution. When we wish to give emetina in a liquid form, it may be readily dissolved in water by the aid of acetic or dilute sulphuric acid.

3. STARCH.—The cortical portion of the root abounds in starch, the grains of which are compound, and consist of particles which present more or less flattened faces, some being mullar-shaped, others dihedral or trihedral at one end.

4. IPECACUANHA ACID, $C^{14}H^{8}O^{6}$.—This acid was mistaken by Pelletier for gallic acid. It is reddish-brown, bitter, soluble in ether, alcohol, and water. It colours the persalts of iron green, and acts as a reducing agent on the salts of silver and mercury. It absorbs oxygen from the air and becomes darker coloured.

CHEMICAL CHARACTERISTICS.—A decoction of the root, filtered and allowed to cool, becomes, on the addition of a solution of free iodine, blue (*iodide of starch*). Tincture of nutgalls forms in the decoction, as well as in the tincture diluted with water, a greyish-white precipitate (*tannate of emetina*). Sesquichloride of iron communicates a greenish tint (*ipecacuanhate of iron*) to the decoction as well as to the diluted tincture. A solution of isinglass forms in the infusion, after twelve hours, a precipitate. Alcohol renders the decoction turbid (*gum*). Diacetate of lead forms with the tincture, and especially with the decoction, a precipitate (*colouring matter*, *gum*, and *oxide of lead*).

PHYSIOLOGICAL EFFECTS.—If the powder or dust of ipecacuanha be applied to the eyes or face, it acts as an irritant, and causes redness and swelling of these parts. Inhaled, it irritates the respiratory passages, and, in some persons, brings on difficulty of breathing, similar to an attack of spasmodic asthma.[1] Mr. Roberts, surgeon at Dudley, is affected in this way; and I have received from him the following account of his case:—"If I remain in a room where the preparation of ipecacuanha is going on—for instance, making the pulv. ipecac. comp.—I am sure to have a regular attack of asthma. In a few seconds dyspnœa comes on in a violent degree, attended with wheezing and great weight and anxiety about the præcordia. The attack generally remains about an hour, but I obtain no relief until a copious expectoration takes place, which is invariably the case. After the attack is over I suffer no further inconvenience. I have always considered that the attack proceeds from the minute particles of the ipecacuanha floating in the atmosphere acting as an irritant on the mucous membrane of the trachea and bronchial tubes." In some cases the mere odour of the root seems sufficient to excite difficulty of breathing, with a feeling of suffocation.

There is one case recorded of poisoning by the incautious inhalation of the dust of ipecacuanha, in the process of powdering it, by a druggist's assistant. It is mentioned by Dr. Prieger.[2] The patient, who was suffering with catarrh and cough, inhaled, during three hours, the dust from the root; in consequence of which, vomiting came on, followed by a tightness of the chest. An hour after this he complained of a sense of suffocation, and constriction of the trachea and throat: his appearance was pale and deathly. The physician who was called in bled him, and gave assafœtida and belladonna, with temporary relief; but in five hours a fresh attack came on, with the most imminent danger of suffocation. A strong decoction of uva-ursi, with the extract of rhatany, was administered, with almost immediate relief, and in an hour his breathing was much freer. He was able to leave the house in two days, but suffered several days with difficulty of breathing.

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[1] Scott, *Phil. Trans.* for 1776, p. 168.

[2] *Rust's Mag.* B. xxxii. H. i. S. 182.

When taken *in small and repeated doses*, ipecacuanha principally directs its influence to the secreting organs, especially those of the chest, whose activity it promotes. It specifically affects the bronchial membrane, in some morbid conditions of which it promotes expectoration, while in others, attended with a profuse secretion of phlegm, it exerts a beneficial influence, and often contributes to the restoration of the part to its normal condition. *In somewhat larger doses* it creates nausea, with its concomitant phenomena, depression, increased secretion of saliva and buccal mucus, &c. If a diaphoretic regimen be adopted, it exerts a powerfully relaxing influence over the skin. *In full medicinal doses* it occasions vomiting, followed by a tendency to sleep. Its operation as an emetic is exceedingly safe, since inflammation is not produced by it, even when an overdose has been swallowed.

The vomiting produced by ipecacuanha is not so violent as that induced by emetic tartar, neither is it so long continued, nor attended with such nausea and depression. Furthermore, ipecacuanha is less disposed to act on the bowels. The tonic and astringent qualities of the zincic compounds, as well as their want of diaphoretic power, distinguish these emetic substances from ipecacuanha. Squill (with which ipecacuanha agrees in its expectorant and emetic qualities) is distinguished by its greater acridity, and by its influence not being concentrated on the pulmonary organs, as is the case with ipecacuanha, which does not, therefore, possess that power of stimulating the urinary organs possessed by squill.

The most remarkable of the effects of ipecacuanha seem to be produced by the agency of the eighth pair of nerves. "How singular it is," says Dr. M. Hall,[1] "that ipecacuanha taken into the bronchia should excite asthma, and taken into the stomach should induce another affection of the respiratory system, vomiting." Sundelin[2] ascribes the red condition of the bronchial membrane, and the congestion of the lungs of animals killed by emetine, not to the specific stimulus exerted by this substance over the pulmonary mucous membrane, but to an exhausting stimulus over the eighth pair of nerves, by which a condition similar to suffocative catarrh (*Steckfluss*) is brought on; for he has observed the same appearances in the bodies of persons who have died of this disease, where there was certainly no inflammatory condition of the bronchial membrane, but a paralytic condition of its small blood-vessels.

USES.—Ipecacuanha is employed in full doses as an emetic, or in smaller doses as an expectorant and nauseant.

1. *In full doses, as an emetic.*—The mildness of its operation adapts

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[1] *Lectures in the Lancet*, for April 21, 1838.

[2] *Handb. d. sp. Heilmittell.* ii. 5.

ipecacuanha for the use of delicate and debilitated persons, where our object is merely to evacuate the contents of the stomach. Thus it is well fitted for the disorders of children requiring the use of emetics (as when the stomach is overloaded with food in hooping-cough, croup, &c.), on account of the mildness and certainty of its action. It is also exceedingly useful for adults (especially delicate females); thus, in gastric disorders, to evacuate undigested acrid matters from the stomach,—to promote the passage of biliary calculi,—as a counter-irritant at the commencement of fevers,—in many inflammatory diseases (as acute mucous catarrh, cynanche, hernia humoralis, and ophthalmia),—in asthma,—and as an evacuant in cases of narcotic poisoning. When the indication is to excite gentle vomiting in very weak and debilitated frames, Dr. Pye[1] has shown that it may be effected frequently with the utmost ease and safety by ipecacuhana in doses of from two to four grains. Dr. Cullen[2] has expressed some doubt with respect to the correctness of this statement; but it is well known that ten grains of Dover's powder (containing one grain of ipecacuhana) not unfrequently cause vomiting.

The mildness of its operation is not the only ground for preferring ipecacuanha to other emetic substances. Its specific power over the pulmonary organs and the stomach leads us to prefer it in maladies of these parts, in which vomiting is likely to be beneficial; especially in those affections in which the nerves appear to be more than ordinarily involved, as spasmodic asthma and hooping-cough. In the first of these complaints Dr. Akenside[3] has shown that it proves equally serviceable even when it fails to occasion vomiting, and merely produces nausea. He gave a scruple, in the paroxysm, to create vomiting, and, in the interval, five grains every morning, or ten grains every morning. Dr. Wright[4] recommends gentle emetics of ipecacuanha at the commencement of the treatment of dysentery.

2. *In small doses, as a nauseant, antispasmodic, diaphoretic, and expectorant.*—When given in doses insufficient to occasion vomiting ipecacuanha is serviceable in several classes of complaints, especially those of the chest and alimentary canal.

α. In affections of the respiratory organs.—Nauseating doses of ipecacuanha, are used with considerable advantage in acute cases of *mucous catarrh*. They favour expectoration and relaxation of the cutaneous vessels. In milder and more chronic forms, smaller doses, which do not occasion nausea, will be sufficient. In children, who bear vomiting much better than adults, full nauseating or even emetic doses are to be preferred.

"When a child becomes hoarse, and begins to cough," says Dr. Cheyne,[5] "let every kind of stimulating food be withdrawn; let him be confined to an apartment of agreeable warmth; have a tepid bath; and take a drachm of the following mixture every hour, or every two hours if it produces sickness:—℞ Vini Ipecacuanhæ, ʒiij.; Syrupi Tolut. ʒv.; Mucil. Acaciæ, ℥j. Mix.; and all danger will probably be averted:

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[1] *Med. Obser. and Inq.* vol. i. 240.

[2] *Mat. Med.* ii. 474.

[3] *Med. Trans.* i. 93.

[4] *Memoirs of*, pp. 379 and 397.

[5] *Cyclop. of Pract. Med.* art. *Croup*, vol. i. p. 496.

whereas, if no change be made in the quality of the food, and if he be sent into the open air, he will probably undergo an attack of bronchitis or croup."

In *hooping-cough*, in which disease considerable benefit is obtained by the use of emetic substances, ipecacuhana is frequently administered with advantage. After giving it to create vomiting, it should be administered in nauseating doses. In *asthma*, benefit is obtained by it, not only when given so as to occasion nausea and vomiting, as above noticed, but also in small and repeated doses. In both this and the preceding disease, the benefit procured by the use of ipecacuanha arises, not from the mere expectorating and nauseating operation alone of this remedy, but from its influence otherwise over the eighth pair of nerves. In *bronchial hemorrhage* (hæmoptysis) the efficacy of ipecacuanha has been greatly commended. A. N. Aasheim,[1] a Danish physician, gave it in doses of one-fourth of a grain every three hours during the day, and every four hours during the night. In this way it excites nausea, and sometimes even vomiting. It checks the hemorrhage, alleviates the cough, and relaxes the skin.

β. *In affections of the alimentary canal.*—In *indigestion*, Daubenton[2] gave it in doses just sufficient to excite a slight sensation of vermicular motion of the stomach, without carrying it to the point of nausea. Eberle[3] tried it, in his own case, with evident advantage. An anti-emetic quality has been assigned to it by Schönheider.[4] In *dysentery*, ipecacuanha has gained no trifling celebrity, whence its name of *radix antidysenterica.* In severe forms of the disease no one, I suspect, now would think of relying on it as his principal remedy; but, as an auxiliary, its efficacy is not to be denied. The advocates for its use, however, are not agreed as to the best mode of using it. Sir George Baker[5] and Dr. Cullen[6] consider it to be of most benefit where it acts as a purgative; but this can scarcely be its *methodus medendi.* From my own observations of its use in the milder forms of dysentery met with in this country, I am disposed to ascribe its efficacy in part to its diaphoretic powers, since I have always seen it promoted by conjoining a diaphoretic regimen. But its tendency to produce an antiperistaltic movement of the intestines doubtless contributes to its antidysenteric property. It is best given, I think, in conjunction with opium. Its determination to the skin should be promoted by warm clothing, and the free use of mild, tepid aliments. Mr. Twining[7] gave ipecacuanha in large doses (grs. vj.), with extract of gentian, without causing vomiting. Mr. Playfair[8] recommends from half a drachm to a drachm of ipecacuanha, with from thirty to sixty drops of laudanum, to be given at the commencement of the disease.

γ. *In various other maladies.*—As a sudorific, ipecacuanha is given in combination with opium (see *Pulvis Ipecacuanhæ compositus*) in various diseases. On the continent it is esteemed as an antispasmodic. In uterine hemorrhage, also, it has been employed. In chronic visceral enlargements it has been administered as a resolvent.

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[1] *Vis anthæmopt. rad. ipec.* in *Acta Reg. Soc. Med. Hafn.* i. 170.

[2] *Mém. sur les Indigest.* 1798.

[3] *Treat. of the Mat. Med.* i. 44, 2d edit.

[4] *Acta Reg. Soc. Hafn.* ii. 139.

[5] *De dysenteria*, 1761.

[6] *Mat. Med.* ii. 477.

[7] *Trans. of the Med. and Phys. Soc. of Calcutta*, vol. iv. p. 170.

[8] *Edinb. Med. and. Surg. Journal*, vol. ix. p. 18.

ADMINISTRATION.—The usual dose of ipecacuanha, in *powder*, as an *emetic*, is grs. xv. But a much smaller quantity (for example, six, or four, or even two grains) will frequently suffice, as I have before mentioned. But a scruple, or half a drachm, may be taken with perfect safety. A commonly-used emetic consists of one grain of emetic tartar, and ten or fifteen grains of ipecacuanha. For infants, half a grain or a grain of this root is usually sufficient to occasion vomiting. In all cases the operation of the remedy should be assisted by diluents. As a *nauseant*, the dose is from one to three grains. As an *expectorant* and *sudorific*, the dose should not exceed one grain: for infants, one-quarter or one-eighth of a grain. *Ipecacuanha lozenges* contain usually from a quarter to half a grain of the powder, and may be used in catarrhal affections to promote expectoration. *Infusion of ipecacuanha* (prepared by digesting ʒij. of the coarsely-powdered root in f℥vj. of boiling water) may be used as an emetic, in cases of narcotic poisoning, in doses of f℥j. to f℥ij.

1. VINUM IPECACUANHÆ, L. E. D.; *Wine of Ipecacuanha*. (Ipecacuanha, bruised, ℥ijss.; Sherry Wine, Oij. Macerate for seven [fourteen, *D.*] days, and strain.)—According to Dr. A. T. Thomson, a pint (*i. e.* f℥xvj.) of wine takes up 100 grains of the soluble matter of ipecacuanha. This preparation is diaphoretic, expectorant, and emetic.—Dose for an adult, as a diaphoretic and expectorant, ♏x. to ♏xl.; as an emetic, fʒij. to fʒiv. On account of the mildness of its operation, it is given, as an emetic, to children: the dose is from ♏xx. to fʒj., according to the age of the child. It is also exceedingly useful as an expectorant in the diseases of infants: dose from ♏v. to ♏x.

2. SYRUPUS IPECACUANHÆ, E.; *Syrup of Ipecacuanha*. (Ipecacuanha, in coarse powder, ℥iv.; Rectified Spirit, Oj.; Proof Spirit and Water, of each, f℥xiv.; Syrup, Ovij. Digest the ipecacuanha in four fluid ounces of the rectified spirit, at a gentle heat, for twenty-four hours; strain and squeeze the liquor, and filter. Repeat this process with the residuum and proof spirit, and again with the water. Unite the fluids, and distil off the spirit till the residuum amount to twelve ounces; add to the residuum five fluid ounces of rectified spirit, and then the syrup.)—A syrup of ipecacuanha is a very useful preparation for children; but some difficulties attend its preparation. An aqueous decoction of this root contains so much starch that it can scarcely be filtered. Even the infusion filters slowly, is always turbid, and yields a syrup which does not keep well. Hence MM. Guibourt and Henry[1] introduced a process, of which that of the Edinburgh Pharmacopœia is a modification (improvement?). They prepared an alcoholic extract, which is dissolved in water and mixed with concentrated syrup. About two fluid-scruples of the Edinburgh preparation contain the strength of one grain of ipecacuanha: hence the dose of it, as an *emetic*, for infants, will be half a teaspoonful; for adults, f℥j. or f℥iss. As an *expectorant*, the dose is fʒj. to fʒij.

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[1] *Pharm. Raison.* i. 502, 2de édit.

3. PULVIS IPECACUANHÆ COMPOSITUS, L. E. D.; *Compound Powder of Ipecacuanha; Dover's Powder; Pulvis Doveri*, offic. (Ipecacuanha, powdered, Hard Opium, powdered, of each, ʒj.; Sulphate of Potash, powdered, ℥j. Mix them. The proportions used by all the British Colleges are the same.)—This preparation is an imitation (though not a very exact one) of a formula given by Dover:[1] whence it is commonly known in the shops as *Dover's Powder*. The following is Dr. Dover's recipe:—

> "Take opium, ℥j.; saltpetre, tartar vitriolated, of each, ℥iv.; ipecacuhan, ℥j.; liquorice, ℥j. Put the saltpetre and tartar into a red hot mortar, stirring them with a spoon until they have done flaming. Then powder them very fine. After that, slice in your opium; grind these to a powder, and then mix the other powders with them. *Dose*, from 40 to 60 or 70 grains in a glass of white wine posset, going to bed. Covering up warm, and drinking a quart or three pints of the posset drink while sweating."

The compound powder of ipecacuanha is one of our most certain, powerful, and valuable sudorifics. The sulphate of potash is intended to serve the double purpose of promoting the sudorific operation of the other ingredients, and of minutely dividing, by the hardness of its particles, the opium and ipecacuanha. The nitrate of potash also employed by Dr. Dover probably contributed still further to the sudorific effect of the powder. The opium and ipecacuanha, combined, enjoy great sudorific properties not possessed by either of these substances individually. I am inclined, however, to ascribe the greater part of the activity of the compound to the opium, which, it is well known, strongly determines to the cutaneous surface (see OPIUM), and often produces pricking or itching of the skin; and, when assisted by the copious use of warm aqueous diluents, operates as a sudorific. This effect, however, is greatly promoted by the ipecacuanha, which has a relaxing influence over the cutaneous vessels. The use of the posset, enjoined by Dr. Dover, is an important part of the sudorific plan. The contra-indications for the use of compound powder of ipecacuanha are an irritable condition of the stomach (when this preparation is apt to occasion sickness), and cerebral disorder. Thus, in fever, a dry furred tongue, and a dry skin, with much disorder of the cerebro-spinal functions, it, like other opiates, is calculated to prove injurious. In such cases, the antimonial sudorifics may be resorted to. But when the tongue is moist,—the skin, if not damp, at least soft,—and the functions of the brain not much involved, it will probably operate beneficially. In slight colds, catarrhs, and rheumatic pains, it often proves most effectual. In various inflammatory affections, when the febrile excitement does not run too high, and when the brain is undisturbed, it may be used with good effect. In acute rheumatism it is occasionally highly serviceable; in diarrhœa and dysentery also. In hemorrhages from internal organs, as the uterus, it is useful on the principle of revulsion or counter-irritation, by its power of determining to the skin. The dose of this preparation is usually from grs. v. to grs. x., given in currant jelly or gruel, or made into a pill (see *Pilulæ Ipecacuanhæ et Opii*), or administered in a common saline draught. Where the stomach is irritable, I have frequently seen five grains cause sickness.

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[1] *The Ancient Physician's Legacy to his Country*, p. 14, 1733.

On the other hand, in some cases where a powerful sudorific is requir
and the head quite free, grs. xv. or even ℈j. of this powder are not
frequently given.

4. PILULÆ IPECACUANHÆ CUM SCILLA, L.; *Pilulæ Ipecacuanhæ c*
positæ, Ph. Lond. 1836; *Pills of Ipecacuanha and Squills.* (Compo
Powder of Ipecacuanha, ℥iij.; Squill, fresh-dried, in powder, Amm
niacum, in powder, of each, ℥j.; Treacle, as much as may be suffici
Beat them together until incorporated.)—Narcotic and sudorific. E
ployed in chronic catarrh.—Dose, grs. v. to grs. x.

5. PILULÆ IPECACUANHÆ ET OPII, E.; *Pills of Ipecacuanha and Opi*
(Powder of Ipecacuanha and Opium, *three parts;* Conserve of Red Ro
one part. Beat them into a proper mass, which is to be divided i
four-grain pills.)—The properties of this are the same as those of *Pu*
Ipecacuanhæ compositus.—Dose, one to three pills.

6. TROCHISCHI MORPHIÆ ET IPECACUANHÆ. (See *Morphia.*)

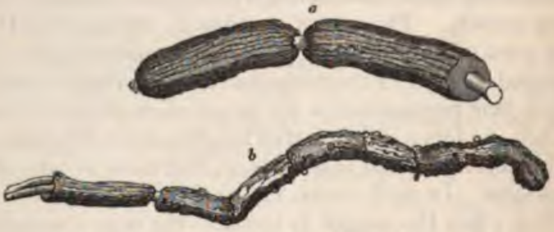
236. Psychotria emetica, *Mutis.*—Striated Ipecacuanha.

Sex. Syst. Pentandria Monogynia.

(Radix.)

Ronabea emetica, Richard.—A small perennial plant, which grows in Peru and
Granada, and on the banks of the Magdalena. Its roots constitute the *striated ip*
cuanha (*radix ipecacuanhæ striatæ*) of Richard, Guibourt, and Mérat; the *blac*
Peruvian ipecacuanha (*radix ipecacuanhæ nigræ* vel *peruvianæ*) of some other auth

FIG. 9.



Striated Ipecacuanha (*Roots of Psychotria emetica*).
a. An old root with a well-marked intersection. *b.* Contorted root.

They are neither annulated nor undulated, but longitudinally striated. They
deep circular intersections at various distances, giving them the appearance of b
articulated; and, when slight force is used, they fracture at these parts. As met
in commerce, they have externally a blackish-grey colour, with a brownish tinge;
when fresh, they are said to be dirty reddish-grey. Their fracture is resinous:
meditullium, or central ligneous cord, is yellowish, and perforated by numerous h
which are very visible by a magnifier; the cortical portion is softish, easily separ
and of a greyish-black colour, becoming much deeper when moistened. Its powd
deep grey. According to the analysis of Pelletier,[1] this root consists of—*emeti*
fatty matter 12, *gallic acid* a trace, *gum*, *starch*, and *ligneous matter* 79. In its medi
qualities it resembles the annulated or true ipecacuanha, than which it is some
weaker; but it is not met with in English commerce.

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[1] *Journ. de Pharm.* t. vi. p. 265, 1820.

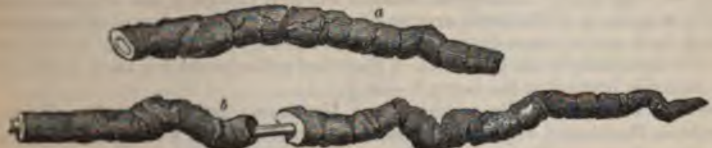
237. Richardsonia scabra, *De Cand.*—Undulated Ipecacuanha.

Sex. Syst. Hexandria Monogynia.

(Radix.)

Richardsonia pilosa, Ruiz et Pavon; *Richardia brasiliensis*, B. A. Gomes.—A perennial plant; a native of the Brazils, New Granada, Peru, Vera Cruz, &c. Its root is the *undulated ipecacuanha* (*radix ipecacuanhæ undulatæ*) of Guibourt; the *amylaceous* or *white ipecacuanha* (*radix ipecacuanhæ farinosæ* seu *amylaceæ*) of Mérat. It has a jointed appearance, from constrictions which are remote from each other. It is about the same size as that of the annulated species; is tortuous, attenuated at the extremities; externally of a greyish-white colour, becoming brownish by age. It presents no rings properly so called, but is marked by semicircular grooves. It consists, like the annulated species, of a thin yellowish meditullium, and a cortical portion.

FIG. 10.



Undulated Ipecacuanha Root.

a. Root of Richardsonia scabra. *b.* Root of a Richardsonia.

The fracture of the root is not at all resinous, but farinaceous, and of a dull-white colour; the fractured surface presenting, when examined by a magnifier, numerous shining pearly, probably amylaceous, spots. The odour is musty. The composition of it, according to Pelletier,[1] is *emetina* 6, *fatty matter* 2, *starch* and *ligneous matter* (very little of the latter) 92. In its medicinal qualities it agrees with the annulated ipecacuanha, than which it is somewhat weaker. This like the preceding sort of ipecacuanha, is not in use in England.

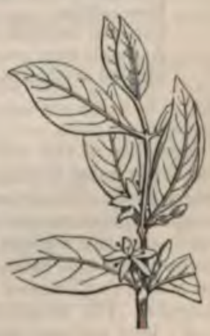
238. Coffea Arabica, *Linn.*—The Coffee Tree.

Sex. Syst. Pentandria Monogynia.

(Semina.)

According to manuscripts contained in the Bibliothèque Royale at Paris, coffee was in use in Persia in the year A.D. 875.[2] It was first introduced into England in 1652.[3] The coffee plant is a native of Arabia Felix and Ethiopia, but is extensively cultivated in Asia and America. It is an ever-green *shrub*, from 15 to 20 feet high, with oblong-ovate, acuminate, smooth *leaves*, a 5-toothed *calyx*, a white tubular *corolla*, with a 5-parted spreading limb, 5 *stamens*, 1 *pistil* with a bifid style, and an oval, succulent, blackish-red or purplish 2-seeded *berry*. The *seeds* are enclosed in a membranous endocarp (the parchment-like putamen of some botanists), and are convex on one side, and flat with a longitudinal groove on the other. They consist of a horny, yellow, bluish or greenish convoluted albumen, at the one end of which is the embryo, with its cordiform cotyledons; the position of the radicle being indicated by the micropyle.—The *dried fruits* or berries are rarely imported. In 1839 there was an importation of them into London from Demerara. Occasionally the seeds contained in their endocarp (*coffee in the husk*) are met with in

FIG. 11.



The Coffee Tree.

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[1] *Dict. des Drogues*, t. iii. p. 265, 1828.

[2] Mérat and De Lens, *Dict. Mat. Méd.* tom. ii. p. 345.

[3] *Phil. Trans.* vol. xxi. p. 311, 1699.

commerce. The *raw coffee* of the shops consists of the seeds (in commerce frequently, but erroneously, called "berries") deprived of their endocarp and in part of their testa. Portions of the testa are, however, found on the convex surface, and lining the groove on the flat surface. The varieties of raw coffee are distinguished in commerce according to their places of growth; but considered with reference to their physical properties, they are characterised by colour (yellow, bluish, or greenish) and size (th smallest seeds are about three lines long and two broad, the largest five lines long an two lines and a half broad). Arabian or Mocha coffee is small and dark yellow. Jav and East India (Malabar) kinds are larger, and paler yellow. The Ceylon is mor analogous to the West India kinds (Jamaica, Berbice, Demerara, Dominica, Barbadoes &c.), which, as well as the Brazilian, have a bluish or greenish-grey tint. The structure of the raw coffee seed has been fully described and depicted by Dr. Hassall.[1] Th testa or investing membrane of the seed is made up of very elongated cells more o less tapering at one or both extremities, with oblique markings on their surface. I the act of roasting it separates from the seed, and is commonly termed by the roaster "flights" or "the fibre." The great mass of the seed (vulgarly and improperly calle "berry") is made up of the perisperm or albumen, which is composed of angular cells containing each one or more drops of aromatic volatile oil. The cells of the embry are smaller than those of the albumen. [Torrefied coffee leaves are used in the wester part of Sumatra instead of the berry.[2]—ED.]

Coffee has been chemically examined by Hermann, Cadet, Schrader, Robiquent and Boutron, Rochleder, Payen, and others. Schrader made a comparative examination of raw and roasted Martinique coffee, and obtained the following results:—

Peculiar coffee principle	17·58
Gummy and mucilaginous extract	3·64
Extractive	0·62
Resin	0·41
Fatty oil	0·52
Solid residue	66·66
Loss (water?)	10·57
Raw coffee	100·00

Coffee principle	12·50
Extractive	4·80
Gum and mucilage	10·42
Oil and resin	2·08
Solid residue	68·75
Loss	1·45
Roasted coffee	100·00

The latest quantitative analysis of coffee is that of Payen,[3] who gives the followin as the approximative composition of it:—

Cellulose	34·000
Water (hygroscopic)	12·000
Fatty substances	10 to 13·000
Glucose, dextrine, and undetermined vegetable acid	15·500
Legumine, caseine (glutine)?	10·000
Chlorogenate [caffeate] of potash and caffeine	3·5 to 5·000
Nitrogenous substance	3·000
Free caffeine	0·800
Concrete essential oil	0·001
Aromatic fluid essential oil	0·002
Mineral substances	6·697
	100·000

A decoction of raw coffee is coloured green by the persalts of iron. Raw coffe macerated in water undergoes fermentation, and evolves carbonic acid and sulphurette hydrogen gases. This fermentation is probably due to the decomposition of an albuminous and sulphurous substance contained in coffee. Alcohol extracts from raw coffe a double salt, the *caffeate* (called by Payen the chlorogenate) *of potash and caffein* Berzelius states that caffeic acid ($C^{14}H^{8}O^{7}$ according to Payen) bears the same relatio to the tannin (*caffeotannic acid*) of unroasted coffee, that gallic acid bears to the tanni of nutgalls. The *aromatic volatile oils* of raw coffee are tenaciously retained by th *fatty oil*; they undergo alteration of properties by the operation of roasting. *Caffein* ($C^{8}H^{5}N^{2}O^{2}$) is a weak alkaloid, white, crystallisable in long silky needles, fusible volatile and soluble in water, alcohol, and ether. Its aqueous solution is precipitated by tannic acid. It is identical with *theine* extracted from China tea, and from Paraguay tea (*Ilex paraguayensis*), and with *guaranin* obtained from guarana (*Paullinia sorbilis*). [Stenhouse finds the coffee leaves to contain 1·25 per cent. of caffeine, while the berries only contain ·80 to 1·00 per cent. The leaves likewise contain 10 per cent. more soluble matter than the berry, and rather more of the caffeic acid.[1]—ED.]

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[1] *Lancet*, Jan. 4, 1851.

[2] *Pharm. Journ.* vol. xiii. p. 208.

[3] *Chemical Gazette*, vol. v. p. 34, 1847.

The chemical changes effected in coffee by roasting, require further investigation. The cells of the seeds are charred and rendered friable, but they retain their characteristic shape. [Lebreton estimates the loss of weight of coffee in roasting at 16 to 20 per cent.[2]—ED.] The volatile oil, however, is no longer visible in them in the form of drops, but appears to have been partially dissipated and partially diffused through the charred cells. The two most interesting products of the torrefaction are *a brown bitter principle*, and *a brown aromatic oil* called *caffeone*.[3] Both of these are products of the decomposition of that part of raw coffee which is soluble in water; for if raw coffee be first exhausted by water, and afterwards roasted, it is then found to yield to boiling water neither the bitter substance nor the aromatic principle. Caffeone is slightly soluble in boiling water, and may be extracted from the distilled water of roasted coffee by means of ether. If coffee be over-roasted, either by employing too high a temperature, or by carrying on the process too long, its flavour is greatly impaired.[4]

The ground coffee sold by grocers is in general largely adulterated.[5] The usual agent employed by the grocers for this purpose is roasted chicory; but as the chicory-roasters frequently adulterate this article, as I have already stated, it follows that besides chicory, properly so called, various other foreign matters may frequently be detected in ground coffee. The following are the readiest modes of proceeding in order to detect the fraud:—

1. Place a portion of the suspected coffee gently upon the surface of cold water in a glass. If it be genuine it becomes very slowly moistened by the water, even when we stir them up together, and in consequence floats on the surface, and communicates scarcely any colour to the liquid. This arises from the coffee being impregnated with volatile oil, which exercises a repulsive influence on the water.

Chicory, on the other hand, readily absorbs and mixes with the water, to which it speedily communicates a deep reddish-brown tint, and sinks to the bottom of the liquid.

Roasted corn and roasted pulse (peas, beans, and lupines) behave, in relation to water, like roasted chicory.

2. An infusion or decoction of pure roasted coffee, when cold, becomes, on the addition of a solution of iodine, of a deeper reddish-brown tint.

A similar effect is produced on the addition of a solution of iodine to an infusion or decoction of pure roasted chicory.

But if roasted corn, roasted pulse (peas or beans), or potatoes be present, the iodine communicates a deep blue, blackish-blue, or purplish-red colour. If the starch of these adulterating ingredients be but little altered by roasting, the resulting colour, on the addition of iodine, will be blue; but if the starch be converted into dextrine, the colour caused by iodine will be purplish-red. The presence of much chicory, however, obscures the effect of this test.

3. If a decoction of genuine roasted coffee be submitted to Trommer's test (see *ante*), it gives no indication of the presence of glucose (grape sugar). By this test burnt sugar or partially charred saccharine matter (sold under the name of "*refining powder*" for adulterating coffee), as well as glucose derived from other sources (as the conversion of amylaceous matters), may be detected.

4. The most important aid in detecting the presence, and in determining the nature, of adulterations of coffee, is the microscope. The presence of chicory may be detected by the size, form, and ready separation of the cells of the cellular tissue, and by the presence and abundance of the pitted tissue (dotted ducts) and vascular tissue or spiral vessels. Roasted corn, pulse, potatoes, and other amylaceous substances, may be detected and

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[1] *Pharm. Journ.* vol. xiii. p. 383.

[2] *Ibid.* vol. xiii. p. 187.

[3] Boutron and Fremy, quoted by Pelouze and Fremy, *Cours de Chimie Générale*, t. iii. p. 250, 1850.

[4] For further details, see Payen's paper before quoted.

[5] See a paper by the author, in the *Pharmaceutical Journal*, vol. iv. p. 85, 1844; also Dr. Hassall's reports, in the *Lancet* for Jan. 4th, April 26th, May 3d, and Nov. 1st, 1851.

identified by the characters (size, shape, and markings) of the starch grains. (For further details, see Dr. Hassall's observations contained in the *Lancet.*)

Raw coffee must be slightly nutritious, on account of the gum and other nutritive principles which it contains. Rasori employed it, like powdered bark, in intermittent fever; and Grindel used it, in other cases, also as a substitute for cinchona. [M. Delcoux considers that the decoction of unroasted coffee is one of the best substitutes for quinine in the treatment of intermittent fever, and in cases where quinine is used he recommends it as an auxiliary to the latter remedy. He does not find it excite the nervous system, or cause sleeplessness, like the ordinary decoction of roasted coffee.[1]—ED.] By roasting, its nutritive principles are (for the most part) destroyed, while the empyreumatic matters developed communicate a stimulant influence with respect to the nervous system.

Roasted coffee possesses powerfully anti-soporific properties: hence its use as a drink by those who desire nocturnal study, and as an antidote to counteract the effects of opium and other narcotics, and to relieve intoxication. In those unaccustomed to its use, it is apt to occasion thirst and constipation. On some persons it acts as a slight purgative It is occasionally useful in relieving headache, especially the form called nervous. It has also been employed as a febrifuge, in intermittents; as a stomachic, in some forms of dyspepsia; and as a stimulant to the cerebro-spinal system, in some nervous disorders Floyer, Dr. Percival, and others, have used it in spasmodic asthma; and Laennec[2] says "I have myself seen several cases in which coffee was really useful." The immoderate use of coffee is said to produce nervous symptoms,—such as anxiety, tremor, disordered vision, palpitation, and feverishness.

The action of caffeine requires further investigation. Mulder gave a grain of it to a rabbit: the animal ate but little the next day, and aborted the day after. Liebig has suggested that it probably contributes to the formation of taurine, the nitrogenised constituent of bile. According to Lehmann,[3] caffeine, in doses of from 2 to 10 grains causes violent excitement of the vascular and nervous systems,—palpitations of the heart extraordinary frequency, irregularity, and often intermission of pulse, oppression of the chest, pains in the head, confusion of the senses, singing in the ears, scintillations before the eyes, sleeplessness, erections, and delirium. In all cases an augmentation was found in the amount of urea secreted.

239. CINCHONA, *Weddell.*

C. Calisaya, Condaminea, et species incerta, *L.*—C. Condaminea, micrantha, and other undetermined species, *E. D.*

Sex. Syst. Pentandria Monogynia.

(Cortex, *L.*—The Bark, *E. D.*)

HISTORY.—The precise period and manner of the discovery of the therapeutic power of Cinchona are enveloped in mystery. Some writers (*e. g.* Geoffroy,[4] Ruiz,[5] and Joseph de Jussieu[6]) believe that the Indians were acquainted with it long before the arrival of the Spaniards; whereas others (*e. g.* Ulloa[7] and Humboldt[8]) are of opinion that the natives were ignorant of the medicinal qualities of the bark until the Spaniards discovered them.

The traditions of the mode of discovery of the remedial power are of a very fabulous character. One, told by Geoffroy, is that an Indian was cured of an ague by drinking at a pool into which some cinchona trees had fallen.[1] Another, related by Condamine, is that the Indians observed that the American lions, when ill with ague, eat the cinchona bark! A third, mentioned by Humboldt, and considered to be less improbable, is that the Jesuits accidentally discovered the bitterness of the bark, and tried an infusion of it in tertian ague.

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[1] *Annuaire de Thérapeutique,* 1855, p. 175.

[2] *Treatise on Diseases of the Chest,* by Forbes, 2nd edit. p. 418.

[3] *Physiological Chemistry,* translated by Dr. Day, vol. i. p. 138, Cavendish Society, 1851.

[4] *Tractatus de Materia Medica,* t. ii. p. 179, 1741.

[5] *Quinologia,* Madrid, 1792 (German translation, 1794).

[6] Weddell, *Hist. Naturelle des Quinquinas,* p. 15, 1849.

[7] *A Voyage to South America,* English translation, 3d edit. vol. i. p. 323, 1772.

[8] Lambert's *Illustration of the Genus Cinchona,* p. 22, 1821.

The period when bark was first introduced into Europe is usually stated to be 1640; but Sebastian Badus[2] gives an extract from a letter of a Spanish physician, D. Joseph Villerobel, from which it appears that it was imported into Spain in 1632, though no trial was made of it until 1639.

The statement of Condamine,[3] that the Countess of Chinchon, wife of the Viceroy of Peru, brought some bark to Europe on her return from South America, in 1639, is not improbable: and from this circumstance it acquired the names of the *Cinchona Bark* and the *Countess's Powder* (*Pulvis Comitissæ*). About ten years afterwards it was carried by the Jesuits to Rome, and by them distributed among the members of the order, by whom it was taken to their respective stations, and used with great success in agues. Among those most active in promoting its employment was Cardinal de Lugo. In this way it acquired the names *Jesuit's Bark*, *Pulvis Patrum*, *Jesuit's Powder* (*Pulvis Jesuiticus*), *Pulvis Cardinalis de Lugo*, &c.[4] It fell, however, into disuse, but was again brought into vogue, in France, by Sir Robert Talbor, who acquired great reputation for the cure of intermittents by a secret remedy. Louis XIV. purchased his secret (which proved to be Cinchona), and made it public.[5] Hence it became known in France as *Talbor's powder* or the *English Remedy*.

BOTANY.—Linnæus[6] established the genus Cinchona in 1742. Endlicher[7] first divided it into two sections or sub-genera, one of which he called *Quinquina*,[8] in which the dehiscence of the fruit is from below upwards;—the other, *Cascarilla*, in which the dehiscence is from above downwards. Weddell[9] has formed these two sections into genera, which he calls respectively *Cinchòna* and *Cascarilla*.[10] The distinction rests not merely on the dehiscence of the fruit—an apparently trivial distinction—but on the important fact that the proper cinchona alkaloids have hitherto been discovered in the species of the first section or genus only, which, therefore, exclusively yields *true* or *genuine cinchona* barks. For these reasons, therefore, I shall follow Weddell.

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[1] Weddell (*op. cit.* p. 40) observes, that he doubts whether at Loxa, more than elsewhere, cinchona trees are to be found on the borders of lakes or ponds, unless they have been carried there.

[2] Quoted by Bergen, *Monographie*, p. 84.

[3] *Mém. Acad. Sc. de Paris*, p. 226, 1738.

[4] Geoffroy, *op. supra citato*.

[5] Talbor, *English Remedy*, 1682.

[6] *Genera Plantarum*, ed. 2nda, p. 527, 1742.

[7] *Ibid.* p. 556, 1836-40.

[8] According to Condamine, *Quina* signifies, in the Quichoa language, "a bark;" and the duplication of the word (*Quina Quina*) would be equivalent to saying "the bark of barks."

[9] *Hist. Nat. des Quinquinas*, 1849.

[10] This name (*cascarilla*) for the new genus is highly objectionable (especially in a pharmaceutical point of view), on account of its being already in use to designate a well-known euphorbiaceous bark (*cascarilla* or *eleutheria bark*, see *ante*).—The word *cascarilla* is the diminutive of *cascara* bark, and, therefore, literally signifies "small bark."

Gen. Char.—*Calyx* with a turbinated tube, connate with the ovary, pubescent; limb superior, 5-toothed, persistent; the teeth valvate in præfloration. *Corolla* salver-shaped, with a terete or subpentagonal tube, limb 5-cleft; the segments lanceolate, valvate in æstivation. *Stamens* 5; the filaments inserted in and adnate to the lower tube; anthers linear, inclosed or somewhat exserted at the apex. *Ovary* crowned with a fleshy disk. *Ovules* numerous, peltate, in linear placentæ, which are affixed on both sides of the dissepiment. *Style* simple; stigma bifid, concealed within the tube of the corolla, or somewhat exserted. *Capsule* ovate, oblong, or linear-lanceolate, grooved on both sides, crowned by the limb of the calyx, 2-celled, many-seeded, septicidal, dehiscing from the base to the apex, the valves disjoined, the pedicel split lengthwise. *Seeds* numerous, affixed in angular-winged ultimately free placentæ. *Embryo* straight in the axis of fleshy albumen.—Evergreen *trees* or *shrubs* growing in the intertropical valleys of the Andes between 10° North and 19° South latitude, at from 1200 to 3270 metres (3937 to 10,728 English feet) above the level of the sea. *Trunk* and *branches* terete, with a bitter bark rich in quinine and cinchonine. *Leaves* opposite, entire, petiolated. *Stipules* usually free, and soon deciduous. *Flowers* cymose-paniculate, white or usually roseate or purplish, very fragrant. (Condensed from Weddell.)

Species.—Weddell admits 21 species of this genus; but of these not more than 13 are known to yield their bark for commercial purposes.

1. C. Calisaya, *Weddell.*—Leaves oblong or lanceolate-obovate, obtuse, attenuated at the base, rarely acute at both ends, smooth, shining or pubescent beneath, pitted in the axils of the veins. Filaments usually shorter than one-half the length of the anthers. Capsule ovate, scarcely equal in length to the flowers. Seeds frequently fimbriate-denticulate at the margin (Weddell).—Bolivia and Southern Peru.

Weddell has described two varieties of this species: they are as follows:—

a. Calisaya vera.—A tree, with obtuse oblong-obovate or oblong-lanceolate leaves.—A tall tree. Trunk straight or bent, naked, not unfrequently twice the thickness of a man's body. The leafy head for the most part elevated above all the other forest trees.

It grows in declivities and steep and rugged places of the mountains, at an altitude of from 1500 to 1800 metres [4921 to 5905 English feet], in the hottest forests of the valleys of Bolivia and Southern Peru; between 13° and 16° 30′ South latitude, and from 68° to 72° West longitude; in the Bolivian provinces of Enquisivi, Yungas, Larecaja, and Caupolican; and in the Peruvian province of Carabaya. It flowers in April and May.

The bark is commonly called indiscriminately by the Spaniards and Indians, *Cascarilla Colisaya*, *Calisaya*, or *Culisaya*. It is the *genuine Calisaya* or *yellow bark* of English commerce.

β. Josephiana.—The *Ichu-Cascarilla* or *Cascarilla del Pajonal*[1] [*Meadow Cinchona*] of the natives. A shrub with somewhat acute, oblong-lanceolate or ovate-lanceolate leaves.—From 6½ to about 10 feet high, with a slender branched trunk of from 1 to 2 inches thick. Branches erect. Bark adhering firmly to the wood: that of the trunk and branches schistaceo-blackish, smoothish, or furnished with different lichens, and marked in an annular manner by some narrow, distant cracks; that of the branchlets reddish-brown. It grows in mountainous meadows in the same regions as the preceding variety. Both the bark of the trunk and branches, and of the stumps of the larger roots is collected and occasionally imported with *Calisaya* or *yellow bark*.

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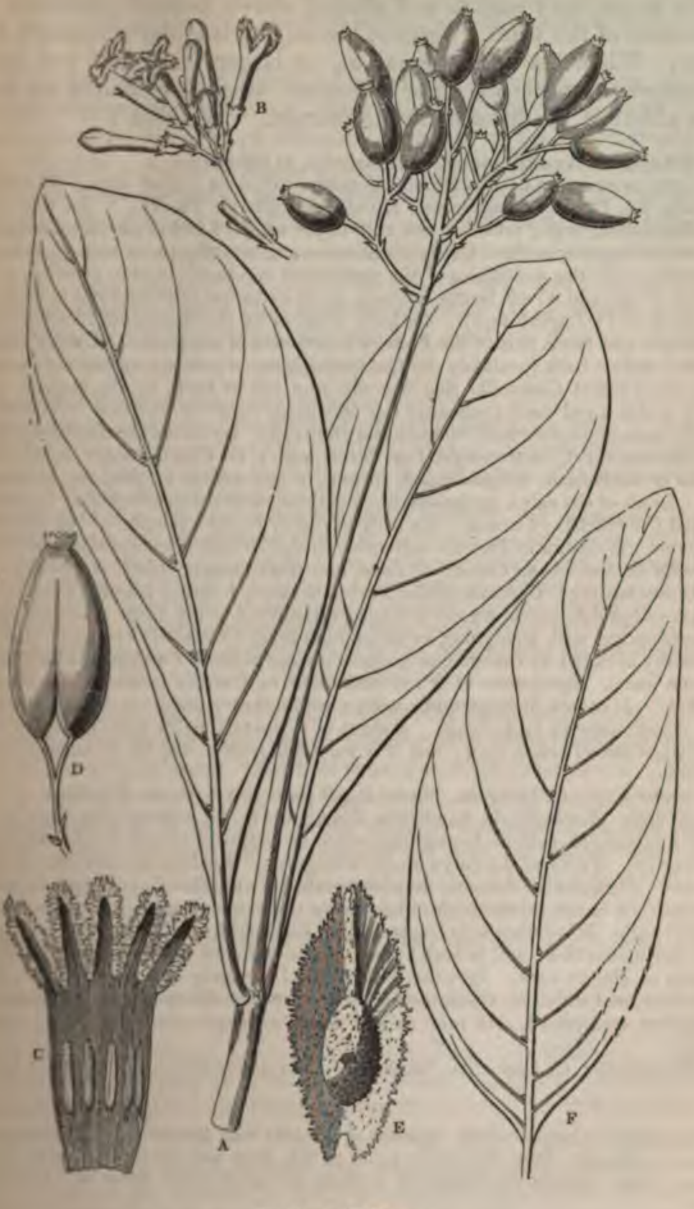
[1] Weddell says that *ichu* in the Quichua language and *paja* in the Spanish signify herb or grass.—*Paja*, however, strictly signifies "straw."

FIG. 12.



Cinchona Calisaya.

Fruit-bearing branch (*from a specimen collected in the province of Carabaya, in Peru*).
Flowers (*natural size*).
Corolla laid open (*magnified*).
D, Capsule (*magnified*).
E, Seed (*magnified*).
F, Leaf of var. *Josephiana* (*from a specimen gathered in the province of Yungas, in Bolivia*).

2. C. **CONDAMINEA**, *Weddell.*—Leaves lanceolate, ovate or subrotund, usually acute, very smooth and shining above, beneath sometimes pitted in the axils of the veins. Teeth of the calyx triangular-acuminate or lanceolate. Filaments nearly equal to, or larger than, half the length of the anthers. Capsule oblong or lanceolate, much longer than the flowers. Seeds elliptical, tooth-letted at the margin. (Weddell.)

Of this species Weddell makes four varieties, as follows:—

α. **CONDAMINEA VERA**; *Quinquina*,[1] Condam. Mém. de l'Acad. Roy. 1738; *Cinchona officinalis*, Sp. Pl.; *C. Condaminea*, Humb. and Bonpl. Pl. Æq. i. 33, t. x.—Leaves ovate-lanceolate, acute, pitted in the axils of the veins. Limb of the calyx subcampanulate, with triangular teeth. Capsule oblong-ovate, scarcely twice as long as it is broad (Weddell).—On the declivities of the mountains of Quito, in the province of Loxa, between 3° 42′ and 4° 40′ South latitude, at an elevation of from 1600 to 2400 metres (=5249 to 7874 English feet). Its bark is called by the Spaniards *Cascarilla fina*[2] *de Uritusinga*, and forms part of the *Loxa* or *crown bark* of commerce. Caldas[3] states that it yields a yellow bark (probably the *Quinquina jaune* or yellow Cinchona of Condamine, and hence is called *Cascarilla fina amarillo* [fine yellow bark] by the natives. A sub-variety yields a red bark (probably the *Quinquina rouge* or red bark of Condamine), and is in consequence termed *colorada fina* [fine red]. Its leaves are thicker and blunter.

β. **CANDOLLII**; *C. macrocalyx*, Pav. MSS. ined.; De Cand. Prodr. iv. 353.—Leaves obovate or subrotund, wedge-shaped, rotund, or subcordate at the base, acutish at the apex. Limb of the calyx campanulate, smoothish, with lanceolate teeth. Stigmata sub-exserted (Weddell).—Cuenca. Its bark probably forms a portion of the Loxa bark of commerce. It occurs in Pavon's collection in the British Museum under the names of *Cascarilla de Quiebro de Cuenca de Loxa*, and *Quina negra*[4] [black cinchona].

γ. **LUCUMÆFOLIA**; *C. lucumæfolia*, Pavon, in Herb. Lamb.; Lindl.; Fl. Med. p. 416. —Leaves elliptical-lanceolate, very obtuse, attenuated at the base. Limb of the calyx subcampanulate, with triangular, subacuminate teeth (Weddell).—Loxa.—The bark of this variety is called by the Spaniards *cascarilla con hojas de Lucuma* [the lucuma-leaved cinchona bark]. Specimens of it are contained in Pavon's collection in the British Museum.[5] It occurs in large quills with a white silvery, lustrous, or corky coat, and is found occasionally in Loxa bark. A chest of it was put up for sale in London, in 1848, under the name of *crown bark:* but it is very different to the bark usually known by this name.

δ. **LANCIFOLIA**; *C. lancifolia*, Mutis, Papel periodico de Santa Fé, Num. iii. Oct. 11, 1793, p. 465; Humboldt, in Lambert's Illust. p. 51; *C. angustifolia*, Ruiz. and Pav. Suppl. à la Quinol. p. 21.—Leaves lanceolate or ovate-lanceolate, acute at both ends, without pits. Teeth of the calyx short, triangular. Anthers usually shorter than the filaments. Capsules for the most part lanceolate (Weddell).—Peru, Equador, and New Granada. In Santa Fé the bark is known by the name of *quina naranjada*, or orange-coloured bark. It is extensively imported into England from Carthagena and other ports of the Caribbean Sea; and is best known to our dealers by the name of *Caqueta* or *Coquetta* or *Bogota bark.* It is the bark which I formerly designated as *new spurious yellow bark*, and which M. Guibourt described as *spongy Carthagena bark* (quinquina de Carthagène spongieux). He now calls it *Mutis's orange-coloured bark* (q. orangé de Mutis).

ε. **PITAYENSIS**; *C. lanceolata*, Bentham.—Leaves lanceolate, very acute at both ends.

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[1] Condamine's plant is usually regarded as identical with Humboldt's *C. Condaminea*; but Guibourt (*Hist. des Drog.* 4me édit. t. iii. p. 99), who has pointed out some differences between them, proposes to distinguish Condamine's plant by the name of "*Cinchona academica.*"

[2] I am indebted to Mr. Berthold Seemann for a specimen of bark gathered by himself in the neighbourhood of Loxa from a tree called there "*Quina fina.*" This bark corresponds to what I have termed *fine silvery crown bark.* Mr. Seemann was also kind enough to lend me, for examination, dried specimens of the flowers and leaves taken from the same branch which he had decorticated. This plant is undoubtedly Humboldt's *Cinchona Condaminea.*

[3] *Pharmaceutical Journal*, vol. xi.

[4] J. E. Howard, *Pharm. Journ.* vol. xi. 1852.

[5] J. E. Howard, *op. supra cit.*

Limb of the calyx 5-parted; the segments linear (Weddell).—New Granada.—It is the probable source of *Pitaya, Colombia,* or *Antioquia bark* (the quinquina Pitaya of M. Guibourt—not the Tecamez, or Acatamez, or bicoloured bark, which is sometimes called Pitaya bark).

3. **C. SCROBICULATA**, *Weddell.*—Leaves oblong or lanceolate, acute at both ends, somewhat coriaceous, above shining, beneath smoothish and minutely pitted in the axils of the veins. Teeth of the calyx triangular, acute. Capsule ovate-lanceolate, scarcely twice as long as it is broad. Wing of the seeds narrowed at the base, setose-toothletted at the margin (Weddell).—Peru; between 4° and 13° of South latitude, at about the same altitude as *C. Condaminea.* It chiefly occurs at Jaen, Cuzco, and Carabaya. Its bark is largely collected, and is sold as a substitute for the Calisaya sort, to which it is greatly inferior. It is to this bark that Guibourt has especially applied the name of *light* (or *flimsy*) *Calisaya of commerce* (Calisaya léger du commerce).

Of this species Weddell makes two varieties:—

α. **GENUINA**; *C. scrobiculata,* Humb. and Bonpl. Pl. Æquin. i. p. 165; *C. purpurea,* Lambert, Ill. p. 6; *C. micrantha,* Lind. Fl. Med. p. 412.—Leaves oblong.—Peru.—Its bark is termed by the Peruvians *Cascarilla colorada del Cuzco* [red Cuzco bark], or sometimes *Cascarilla de Santa-Ana* [St. Ann's bark].

Humboldt[1] says that this species forms immense forests in the province of Jaen de Bracamorros, where it is called *Quina fina.* He adds that the inhabitants of the town of Jaen annually gather large quantities of its barks, which they send to Piura, where they are shipped, on the Pacific, for Lima. These facts would lead us to presume that some portion of the Loxa barks of commerce is derived from this species.

β. **DELONDRIANA.**—All the leaves sublanceolate, smaller than in the typical plant. The pits not very conspicuous.—Middle Peru.—The bark of this variety is known in the London market by the name of *Peruvian Calisaya.*

4. **C. AMYGDALIFOLIA**, *Weddell.*—Leaves lanceolate, subacuminate, acute, attenuated at the base, above shining and veiny, beneath smoothish. Stipules subpersistent. Teeth of the calyx triangular, acute. Anthers equalling the filaments. Capsule lanceolate, slightly pubescent, 3 or 4 times longer than it is broad. Seeds acutely toothletted at the margin (Weddell).—Bolivia and Peru, between 13° and 17° South latitude.—Its bark is called in Peru *cascarilla-echenique,*[2] and by the Bolivians *cascarilla-Quepo or Quepo-cascarilla,* but it has no reputation with them. It occasionally occurs in English commerce, but is not distinguished by any name.

5. **C. NITIDA**, Ruiz and Pavon; Lindl.—Leaves lanceolate-obovate, acute, attenuated at the base, smooth on both sides, shining or slightly hairy beneath, not pitted. Filaments equalling the anthers. Capsule lanceolate, twice as long as it is broad. Seeds lanceolate, toothletted at the margin (Weddell).—In Peru, especially Huanaco, Panatahuas, Casapi, Cuchero, &c., about 10° North latitude.—The bark of this species forms a portion of the *Huanuco* or *grey bark* of English commerce.

6. **C. AUSTRALIS**, *Weddell.*—Leaves broadly elliptical or obovate, obtuse, acute at the base, very smooth on both sides, shining, minutely pitted beneath in the axils of the veins or veinlets. Capsule ovate-

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[1] *Plantes Æquinoxiales.*

[2] It is so called after a certain Colonel Echenique, who collected it in the hope of making a good speculation of it.

lanceolate, remarkably attenuated superiorly. Wing of the seeds setose-toothletted at the margin (Weddell).—South Bolivia, at about 19° South latitude, at an altitude of about 1200 metres [3937 Engl. feet]. Its bark, called by the Bolivians *Cascarilla de la Cordillera* or *de Piray*, or *Cascarilla de Santa Cruz de la Sièrra* [Cordillera, Pira, or Santa Cruz de la Sierra bark] is, perhaps, to be occasionally met with in English commerce, but I have not been able to identify it.

7. C. BOLIVIANA, *Weddell.*—Leaves elliptical- or oblong-obovate, obtuse, cuneate or attenuated at the base, smooth above, smoothish or pubescent and purplish below. Teeth of the calyx triangular. Filaments equalling the anthers.—Bolivia and Peru. In Bolivia it grows in the same localities as the C. Calisaya; also in some of the valleys of the Peruvian province of Carabaya, at 13° South latitude.—Its bark is called in Bolivia *Calisaya morada* [mulberry-coloured Calisaya], and in Peru *Cascarilla verde* [green] *morada.*[1] It is usually intermixed with the bark of the C. Calisaya, and constitutes, therefore, part of the Calisaya bark of commerce. Guibourt classes it among the *light or flimsy Calisaya barks* (Calisayas légers).

8. C. MICRANTHA, *Weddell.*—Leaves broadly ovate, obovate, or roundish, rather obtuse, more or less attenuated at the base, membranous, smooth above, very slightly pubescent beneath, pubescent or hairy on the veins and in the axils. Teeth of the calyx short and acuminate. Fruit-bearing panicle thyrse-like, somewhat compressed. Capsule lanceolate. Wing of the seeds toothletted at the margin (Weddell).—This species grows in the Bolivian provinces Larecaja and Caupolican; in Carabaya, and also near Chicoplaya and Playa Grande, in Peru. Its bark is called by the inhabitants of Huanuco, *Cascarilla provinciana;* in Carabaya it is termed *Motosolo;* and by the Bolivians, *Quepo Cascarilla* or *Cascarilla verde.* It is collected in large quantities in Carabaya, and is confounded with the bark of Cinchona ovata, under the name of *Cascarilla morada ordinaria.* The quilled bark constitutes part of the *Huanuco* or *grey barks* of English commerce; the flat pieces are used to adulterate Calisaya bark.

Weddell makes two varieties of this species.

α. ROTUNDIFOLIA ; *C. micrantha,* Ruiz and Pavon.—Leaves ovate-rotund.—Peru and Bolivia.

β. OBLONGIFOLIA ; *C. affinis,* Weddell.—Leaves oblong-ovate.—Peru.

9. C. PUBESCENS, *Weddell.*—Leaves broadly ovate, subacute, at the base (especially in the younger ones) attenuated, membranous, above smoothish, beneath pubescent, with short petioles. Teeth of the calyx triangular-acuminate. Anthers subsessile. Fruit-bearing panicle loose, straggling. Capsule linear-lanceolate. Seeds setose, toothletted at the margin (Weddell).—Peru and Bolivia.—It occurs frequently between 4° and 16° South latitude.

Weddell makes two varieties of this species.

α. PELLETERIANA ; *C. pubescens,* Vahl.—Leaves on both sides green.—The bark of this variety is known in its native country as *carua-carua* or *cargua-cargua*[1] (indicative of its inferior quality). In Carabaya it is also called *cascarilla or quina amarilla* [yellow bark.] It is known in Europe as *Arico* or *Cusco bark.*

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[1] These names have reference to the colour of the leaves, not of the barks.

β. PURPUREA; *C. purpurea*, Ruiz and Pav.; *Cascarilla morada*, Ruiz.—Adult leaves purplish beneath.—In the valleys about Huanuco, the bark of this variety is called *cascarilla bobo*[2] *de hojas moradas* [the mulberry-leaved booby bark].

10. C. CORDIFOLIA, *Weddell.*—Leaves ovate-suborbicular, obtuse at both ends, or cordate or slightly attenuated at the base, submembranous, above at length smoothish, beneath pubescent, usually with long petioles. Teeth of the calyx short, mucronate. Anthers much longer than the filaments. Panicle subcorymbose. Capsule lanceolate. Wing of the seeds toothletted at the margin, and with small holes (Weddell). This species grows at an altitude of from 1700 to 2700 metres [=5577 to 8858[3] English feet].

Weddell makes two varieties of this species.

α. VERA; *C. cordifolia*, Mutis, MSS. apud Humboldt, in Lamb. Illust. p. 54; Lindl. Fl. Med.—Leaves subcordate, pubescent beneath.—New Granada and Peru.—Its bark is the *quina amarilla* or *yellow bark of Santa Fé*, better known in the English market as *hard Carthagena bark.* By the common people in New Granada it is called *velvet bark.*

β. ROTUNDIFOLIA; *C. rotundifolia*, Pavon, in Lamb. Ill. p. 5; Lindl. Fl. Med.—Leaves rotund, obtuse at both ends, denuded or with veins beneath, and with pubescence above.—Loxa.—It is probably the source of the *ashy crown bark* of commerce.

11. C. PURPURASCENS, *Weddell.*—Leaves large, suborbicular, acute, attenuated at the base, membranous, smoothish above, downy beneath, the younger ones subsessile. Stipules ovate-lanceolate.—Bolivia.—Guibourt thinks that its bark is what he has termed *white Loxa cinchona*, but which Weddell thinks is furnished by C. cordifolia and pubescens.

12. C. OVATA, *Weddell.*—Leaves broadly ovate, subacute, attenuated at the base, subcoriaceous, above at length smoothish, beneath pubescent-tomentose. Teeth of the calyx short, acute. Anthers much larger than the filament. Fruit-bearing panicle diffuse. Capsule lanceolate or oblong-lanceolate. Wing of the seeds fimbriate-toothletted at the margin (Weddell).

Weddell admits three varieties of this:—

α. VULGARIS; *C. ovata*, Fl. Peruv.; *C. pubescens*, Lambert; *C. pubescens* var. β, De Cand.—Leaves on both sides green. The bark, when dry, yellow; the cellular coat persistent, or at length separating more or less from the liber (Weddell).—Peru and Bolivia; from 9° to 17° South latitude, at an altitude of from 1800 to 2300 metres [=5905 to 7546 Engl. feet]. This variety yields the bark called in South and Middle Peru, *Cascarilla pata de Gallareta*, or *Cascarilla pata de Gallinazo.*[4] This bark is frequently met with in English commerce, and is known by the names of *Ash*, *Jaen*, or *Ten bark.*

To this variety must also, for the present, be referred the bark now largely imported into England under the name of *Carabaya bark*, which Dr. Weddell has recently assured Mr. J. E. Howard is the produce of *C. ovata*, var. *a vulgaris.*

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[1] *Carua* or *Cargua* signifies the Llama,—an animal considered to be of an inferior kind. The duplication of the word gives force to the expression, and may be taken to signify (figuratively) "very bad" or "very inferior."

[2] The word *bobo* is equal to that of *fool* or *booby.* The inhabitants have given it this name because, having the same good qualities as the cinchonas, it has not their colour (Laubert).

[3] Boussingault and Goulot state that it occurs most abundantly at an elevation of 1958 English feet (Boussingault's *Rural Economy*, Engl. transl. 2d edit. p. 205, 1845).

[4] *Pata de gallareta*, foot of the wild duck: *pata de gallinazo*, foot of the black vulture (*Vultur Aura*). Poeppig says that the latter name arises from the blackish and radiated appearance caused by some species of Graphis, which generally grows upon the bark.

β. RUFINERVIS.—Leaves beneath sanguineo-venous. The dry bark yellowish, the cellular tunic at length separating from the liber.—Carabaya in Southern Peru, and Bolivia. In Peru the bark is called *Cascarilla-Carabaya*, and sometimes *Cascarilla zamba-morada*.

γ. ERYTHRODERMA.—Leaves submembranous, beneath pubescent, green on both sides. Dry bark of a deep reddish-brown colour, the cellular coat persistent.—Peru. The bark of this variety is of a red colour.

13. C. GLANDULIFERA, *Ruiz* and *Pavon.*—Leaves ovate-lanceolate, acute at both ends, above smoothish, beneath glandular-hairy, and fitted in the axils of the veins. Teeth of the calyx short, triangular, subacuminate (Weddell).—Peru, in 10° South latitude, especially about Panatahuas, Chicoplaya, Monzon, and Cuchero. Its bark, called *Cascarilla negrilla* [blackish bark], forms, according to Poeppig, one of the best Huanuco barks.

14. C. HIRSUTA, *Ruiz* and *Pavon.*—Leaves elliptical-ovate, obtuse, usually subacute at the base, coriaceous, above veiny, ultimately smooth, beneath with setose-pilose veins. Teeth of the calyx lanceolate-acuminate. Tube of the corolla pubescent within at the base of the filaments. Wing of the seeds broad, toothletted (Weddell).—Peru; about Pillao, Acomayo, and Panatahuas, at 10° South latitude. Its bark is called *Cascarilla delgada* or *delgadilla* [slender bark] by the Peruvians. It may, perhaps, be the bark known in English commerce as *wiry crown bark.*

The remaining seven species of Cinchona are not known to yield any of the Cinchona barks of commerce.

15. C. CHOMELIANA, Weddell.—Bolivia.—Its bark approximates in character to that of C. ovata.

16. C. ASPERIFOLIA, Weddell.—Bolivia.—A small tree.

17. C. HUMBOLDTIANA, Lambert, Ill. 7; *C. villosa*, Lindl. Fl. Med.—Peru.

18. C. CARABAYENSIS, Weddell.—Peru.—Its bark is very thin, and has not been collected for commercial purposes.

19. C. MUTISII, Lambert, Ill. 9; *C. glandulifera*, Lind. Fl. Med.—Loxa.

Weddell notices two varieties of this:—

- *a. microphylla; C. microphylla*, Mutis; *C. quercifolia*, Pavon, in Lamb. Ill. p. 9.—This variety is commonly called *Cascarilla con hojas de roble* [oak-leaved cinchona]; and under this name there is a bark in Pavon's collection in the British Museum. It is in quills, with a whitish epidermis, and approximates in appearance to either C. lancifolia or lucumæfolia bark.
- *β. crispa; C. quercifolia var. crispa*, Pavon, in Lamb. Ill. p. 9.

20. C. DISCOLOR, Klotzsch.—Peru.—*Cascarilla hoja de Oliva* [olive-leaved cinchona].

21. C. PELALBA, Pavon.—Peru?

BARK-PEELING.—The method of peeling and preparing the cinchona barks for the market has been noticed by Gray,[1] by Stevenson,[2] by Ruiz, by Pöppig, and more recently by Weddell.

The name of *cascarilleros* [bark-peelers], Mr. Weddell states, is given not only to the men who cut the cinchonas in the woods, but also to those who are specially engaged in this commerce. They gather the bark at all seasons, except the rainy season, which in duration corresponds with our winter; and even during this period the collection of the bark is only suspended on account of the physical obstacles to its continuance.

The cutters are not generally engaged on their own account, but are mostly in the service of some merchant or small company; and are accompanied into the forests by a confidential person called the *mayordomo* or *major domo*, whose duty it is to receive and examine the barks brought to him by the different parties in the forest, and to superintend the distribution of provisions.

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[1] From the papers of Mr. Arrot; *Phil. Trans.* 1737-8, vol. xl. pp. 81-6.

[2] *Narrative of Twenty Years' Residence in South America,* vol. ii. p. 66, 1825.

The first thing done by those who engage in this kind of speculation in a region previously unexplored, is to have it examined by experienced *cascarilleros*, who are called *diestros* or *practicos* [skilled or experienced persons]. The duty of these is to penetrate the forests in different directions, and to ascertain to what points they may be profitably explored. If their report be favourable, a road is immediately commenced up to the point which is to form the centre of the operations; and from this time all those parts of the forests adjacent to the road become provisionally the property of those who have formed it, and no other *cascarilleros* can work there.

On the arrival of the *major domo* with his cutters in the neighbourhood of the part to be explored, he chooses a favourable site for his encampment, as near as possible to a spring or river. He constructs a hut to shelter the provisions and the produce of the cuttings; and if he anticipates having to remain for some time in the same locality, he commences the cultivation of maize and a few vegetables. Experience, indeed, has shown that an abundant supply of provisions is one of the most important conditions of success. The *cascarilleros*, during this time, are distributed through the forest, one by one, or in small parties, each carrying under his *poncho* or cloak, and suspended at his back, provisions for several days, and the coverings which constitute his bed.

The cinchonas rarely constitute an entire forest, but form more or less compact groups, called *manchas*, distributed in different parts of it. In some cases, and most frequently, they grow separately. However this may be, it is in discovering them that the skill of the *cascarillero* is principally exerted. If the position be favourable, the tops of the trees first attract his notice; a slight movement peculiar to the leaves of certain species, a particular colour of the foliage, the aspect produced by a great mass of inflorescence, enable him to distinguish the cinchonas from a great distance. Under other circumstances he confines his inspection to the trunks, of which the external layer of the bark, or *caras* as it is called, presents remarkable characters. Very frequently the dry leaves which he finds on the ground are sufficient to indicate to him the vicinity of the object of his search; and if these indications have been brought there by the wind, he knows in what direction to look. An Indian, under these circumstances, is an interesting object for observation. Passing in and out through the narrow pathways of the forest, glancing through the foliage, and appearing to sniff the earth, he seems to walk like an animal pursuing its prey, and darts forth when he thinks he has discovered the object of his search, nor stops until he has arrived at the foot of the trunk which he has descried from the distance. It is not always, however, that the exertions of the *cascarillero* are productive of such favourable results. Too often he returns to the camp empty-handed, and without provisions; and not unfrequently, when he has discovered on the side of a mountain, indications of the tree, he finds himself separated from it by a torrent or ravine. Entire days may then pass before he can attain the object which, during this period, he allows not to escape from his sight.

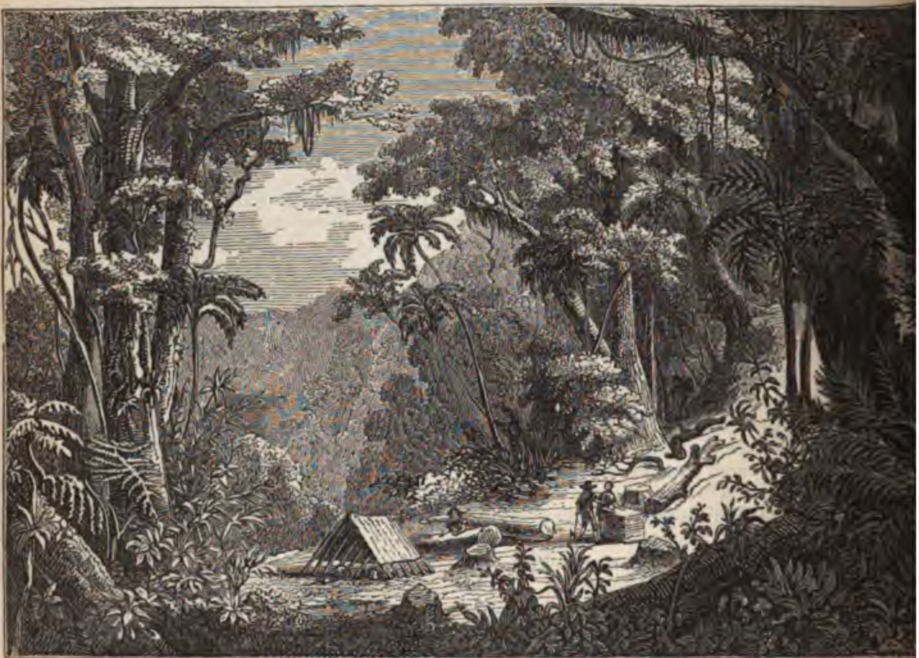
In order to strip the tree of its bark it is felled with a hatchet, being cut a little above the root, and the bark previously removed from this part, so that nothing may be lost; and as at the base the bark is thickest, and, therefore, most profitable, it is customary to remove the earth from around the trunk, so that the barking may be more complete. The tree seldom falls immediately when cut through, being sustained either by climbing plants or by the adjacent trees: these are fresh obstacles to be overcome by the *cascarillero*. I remember, says Mr. Weddell, having once cut the trunk of a large cinchona in the hope of bringing its flowers within reach, and, after having felled three adjacent trees, had the mortification to find it yet standing, being held up by the interlacing creepers.

When at length the tree is down, and the useless branches have been cut off, the periderm is removed by striking it with either a little wooden mallet, or the back of the hatchet; and the inner bark, being thus exposed, is often further cleaned by means of a brush. The bark is then divided by uniform incisions circumscribing the pieces which are to be removed, and these are separated from the trunk with a common knife or some other instrument, the point of which is carried as close as possible to the surface of the wood on introducing it into the incisions previously made; and if the position of the trunk prevents the operator from removing the whole of the bark by the first operation, it is subsequently divided so as to admit of its being turned. The dimensions and regularity of the pieces necessarily depend more or less on circumstances; in general, however, for the convenience of transport and facility of preparation, they endeavour to make them from fifteen to eighteen inches long, and four or five inches wide. The bark of the branches is separated in the same way as that of the trunk, excepting that it is not deprived of its exterior coating or periderm.

The details in the process of drying also vary slightly in the two cases; the thinnest pieces of bark from the branches or small trunks, intended to make the *quilled* bark or *canuto*, are simply exposed to the sun's rays, and they take of themselves the desired form, which is that of a hollow cylinder; but the bark taken from large trunks which is to constitute the *flat* cinchona, or, as it is called, *tabla* or *plancha*, must necessarily undergo a certain degree of pressure during the process of desiccation, without which it would become misshapen, or take a cylindrical form, as in the preceding case. To effect this, after first exposing the pieces of bark to the sun, they are placed one on the other in crossed squares, in a similar manner to that practised in timber-yards in the arrangement of the planks of wood; and on the top of this pile a heavy weight is placed. This process is repeated for several days until the bark is completely dried.

In many places the bark is not pressed at all, or but imperfectly so, and it is then generally out of form or slightly curled. The periderm is often but partially removed, or simply scraped. Finally, whether it be accidental, or whether it be done with the view of augmenting the weight, there frequently remains a certain quantity of moisture in the bark which greatly deteriorates it. The labour of the *cascarillero* is by no means ended, even when he has finished the preparation of the bark; he has yet to carry his spoil to the camp, and, with a heavy load on his shoulders, to retrace his steps along

FIG. 13.



The Valley of San Juan del Oro.

Bark-peeling in the Forests of Carabaya in Peru.

(One of the *cascarilleros* or barkers is represented as engaged in barking a felled stem; two others are occupied in piling the bark in square heaps to flatten and dry it; while a fourth is seen in the distance carrying a load of the dried bark on his back to the camp.)

those parts which, while unburdened, he traversed with difficulty. The labour involved in this part of the operations can hardly be conceived. Mr. Weddell has seen more than one district where the bark had to be carried for fifteen or twenty days' journey to get it out of the wood from which it was obtained.

The packing of the bark is effected by the *major domo*. As the cutters bring him the bark, he submits it to a slight examination, and rejects that which is bad. It is then, if necessary, exposed to a fresh process of desiccation, and formed into bundles of nearly equal weight, which are sewn up in coarse canvas kept for that purpose. In this condition the bundles are conveyed on the backs of men, donkeys, or mules, to the depôts in the towns, where they generally receive an exterior envelope, consisting of a fresh hide, which as it dries makes a hard and compact package. In this form the packages are known by the name of *serons*, and it is thus that they arrive in Europe. The usual weight of a *seron* is from 70 to 80 kilogrammes (=156 to 176 lbs. avoirdupoise); but it is sometimes much less than this.

DESCRIPTION. α. **General Description.**—Before describing the various kinds of cinchona barks met with in commerce, it will be necessary to offer a few remarks on their general characters. These may be noticed under the following heads:—*cryptogamia*, *structure*, *fracture*, *markings*, *quilling*, *colour*, *taste*, and *odour*.

1. CRYPTOGAMIA FOUND ON CINCHONA BARKS.—These, especially the Lichens, have been elaborately examined by Fée[1] and by Zenker.[2]

α. *Musci*, or *Mosses*.—We frequently find mosses on Cinchona barks; but as they are never met with in fructification, it is almost impossible to determine the genus to which they belong. They are probably species of Hypnum.

β. *Lichenes*.—These are found in great abundance, especially on *Loxa* or *Crown Bark*. Formerly their presence was considered to be a mark of goodness of barks, which were valued in proportion to the number of lichens growing on them.

We may conveniently arrange them, according to Zenker, in four sections:—Sect. 1. *Coniolichenes*, or the powdery lichens (*Lichenes pulveracei*).—In this section we have *Lepra flava*. Sect. 2. *Cryolichenes*, or the crustaceous lichens (*Lichenes crustacei*).—These very frequently put on very beautiful forms, and so colour the surface of the epidermis that they appear to constitute a part of this coat. In that kind of pale bark usually called *grey*, or silver, the surface of the epidermis has a white cretaceous appearance, from the presence of various species of Arthonia and Pyrenula. Sect. 3. *Phyllolichenes*, or the foliaceous lichens (*Lichenes foliacei*).—These are found most abundantly on the *Crown* or *Loxa bark*. The most common species belong to the genera Parmelia, Sticta, and Collema. The P. coronata is a beautiful species, and one frequently met with. So also the Sticta aurata, remarkable for its yellow colour. Sect. 4. *Dendrolichenes*, or the filamentous lichens (*Lichenes fruticosi*).—The Usneas are good examples of this section: they are found in abundance on the Crown bark. Two species are met with—U. florida and U. barbata: a variety of the latter is curiously articulated.

γ. *Hepaticæ*.—Jungermannias are found on Cinchona barks, but in too broken a condition to determine their species. Fée, however, examined Humboldt's Herbarium, and found four.

δ. *Fungi*.—As Fungi usually grow on weakly or dead trees, their presence on Cinchona bark is a bad characteristic. Very few, however, are met with. That most commonly met with (especially on quilled Calisaya bark) is *Hypochnus rubrocinctus*, a red fungus.

2. STRUCTURE.—The bark of young Cinchona stems consists of four parts:—1st, the *epidermis* or outer coat, composed of a row of oblong, brownish cells, flattened in the direction from without inwards, and often partially destroyed or blended with the thallus of lichens. 2dly, the *epiphlœum*, also called *phlœum*, *periderm*, or *suberous coat*, composed of layers of oblong tubular cells, which in some barks (as those of C. pubescens and amygdalifolia) constitutes a layer of true cork, but in others consists of a modified

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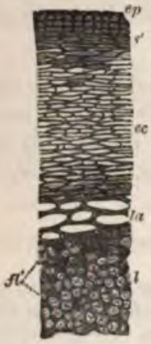
[1] *Essai sur les Cryptog.* 1824.

[2] Goebel and Kunze, *Pharm. Waarenk.* S. 109.

cork, which is distinguished by the name of the *resinous circle*. 3rdly, the *mes*
placed immediately within the suberous coat, and sometimes termed the *cellular*
ceous envelope or *green layer*. It is composed of regular cells, which are flatter
direction from without inwards, and contain resinous matters which readily di
alcohol. This coat is separated from the liber by one or two rows of *lacunæ* a
to *laticiferous vessels*, from which, in the fresh bark, a gummy-resinous, astringe
than bitter, fluid escapes. 4thly, the internal tunic called the *endophlœum* or
composed of pentagonal cells filled with resinous matters, and of woody tissue (
chyma), forming the *cortical fibres*.

FIG. 14.



Transverse section of the very young bark of Cinchona ovata, showing the disposition of the layers before their modification by the progress of vegetation.

ep, Remains of the epidermis.
s', Suberous coat or resinous circle.
ec, Cellular envelope.
la, Lacunæ: these, as well as the cells of the cellular envelope, are filled with resinous matters, which require to be removed, in order to render the cell-walls obvious.
l, Liber,
fl', Cortical fibres.

During the growth and augme
meter of the ligneous axis of the
inner portion of the bark continue
and grow also, but the outer por
and either remains attached to t
living portion forming what is call
bark, (*cinchona cum cortice exterior*
gen), or exfoliates and falls off. T
part is termed by Weddell[1] the *per*
while the living part he calls the *der*
he applies the term periderm to
druggist commonly calls the *coat*
bark; and the word derm to what i
termed *uncoated bark*, or *bark depri*
coats (*cinchona nuda* of Bergen).

3. FRACTURE.—The character of t
verse fracture furnishes an importa
rion of the quality of bark, and has
in use among dealers. It depend
on the anatomical elements of the
partly also on the contents of the cel
cellular tissue breaks with a short an
fracture, and, when the cells abound
the fracture becomes glistening and
Woody tissue, on the other hand, br
a fibrous fracture. In a general w
fore, it may be stated that there ar
kinds of fracture—1st, the *short an*
and 2dly, the *fibrous*. But of th
fracture there are three varieties,
short-fibrous, the *stringy*, and the *li*
woody. These are respectively sho
bark of C. Calisaya, scrobiculata, an
cens. (See figs. 15 to 17.)

The cause of these peculiarities is to be found in the anatomical structure of
as displayed by the microscope. In the *Calisaya bark* the ligneous fibres a
fusiform, equal, loosely attached to each other by their oblique ends, and sur
for the most part individually, by a cellular tissue filled with resin. In the *sc*
bark the ligneous fibres are nearly twice as long, more numerous, and adheren
more tapering extremities. Lastly, in the *pubescens* bark, we find that the
fibres are three or four times as large as those of the preceding barks, and a
together in bundles: moreover the internal face of the bark is formed in gre
cellular tissue (see figs. 18 to 23 inclusive).

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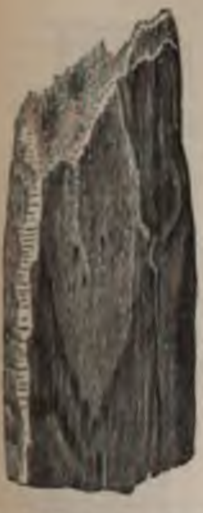
[1] Weddell's terms are convenient, and I shall, therefore, adopt them. But they
means devoid of objection: for while the word periderm is used by Mohl, in a pr
tomical sense, to indicate the epiphlœum or second coat of the bark, Weddell use
loosely to signify merely the dead part of the bark, and does not confine it to o
Thus, in its simplest form, Weddell's periderm is the epiphlœum or suberous coat;
more complex state it consists of the exfoliated mesophlœum chiefly, with the
suberous coat; and, lastly, in some cases it contains also a portion of the liber.

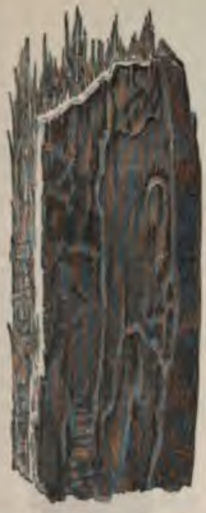
FIG. 15.



Bark of C. Calisaya entirely deprived of periderm.

Short-fibrous fracture of liber.

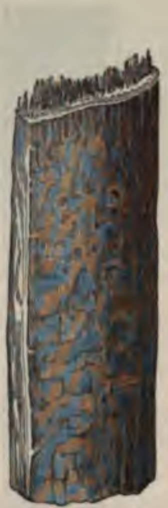
FIG. 16.



Bark of C. Scrobiculata.

Stringy fracture of liber.

FIG. 17.



Bark of C. pubescens coated externally by its periderm.

Smooth or suberous fracture of the external or purely cellular portion of the bark.

Ligneous fracture of the internal portion or liber.

FIG. 18.
Longitudinal section of
C. Calisaya.

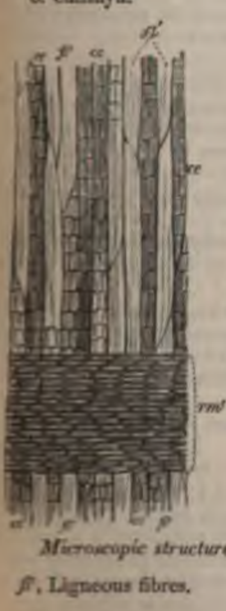


FIG. 19.
Longitudinal section of
C. scrobiculata.

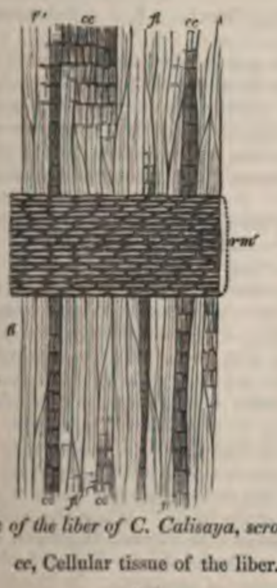
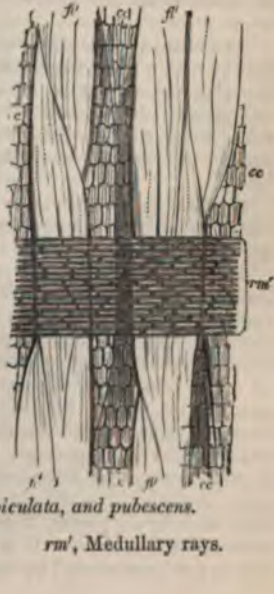


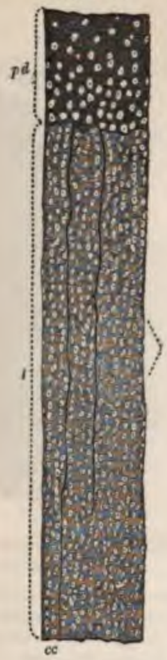
FIG. 20.
Longitudinal section of
C. pubescens.



Microscopic structure of the liber of C. Calisaya, scrobiculata, and pubescens.

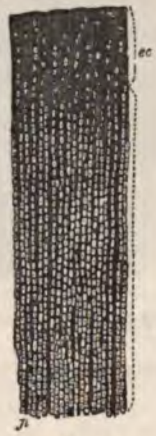
fl', Ligneous fibres. cc, Cellular tissue of the liber. rm', Medullary rays.

FIG. 21.



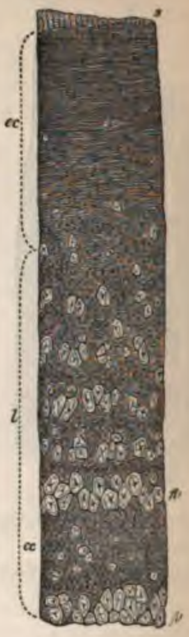
C. Calisaya.

FIG. 22.



C. scrobiculata.

FIG. 23.



C. pubescens.

Microscopic structure of transverse sections of the barks C. Calisaya, scrobiculata, and pubescens.

cc, Cellular tissue of the liber.
ec, Cellular envelope.
fl, Fibres of the liber (*i. e.* cortical fibres).
l, The liber.
pd, A portion of the periderm attached to the liber.
s, Suberous coat.

As Calisaya bark yields a larger proportion of quinine than any other bark, and breaks with a short fibrous fracture, Weddell lays down a general rule, that the more the transverse fracture of a cinchona bark approaches to the short fibrous form, the greater the amount of quinine which we may presume it to contain. On the other hand, the more the fracture approximates to the short or suberous form, the greater the amount of cinchonine. But these rules probably only apply to Bolivian barks.

4. SEAT OF THE ACTIVE PRINCIPLES.—I have repeatedly submitted sections of cinchona barks to microscopic examination, with the view of determining the seat and appearance of the alkaloids in their native tissues.

The liber of many barks presents, even to the naked eye, a speckled appearance, owing to the presence of minute white spots. When we examine these spots by a low magnifying power, they are seen to be cells filled with a white solid substance. If we use the compound microscope, with an object glass of two inches focal length, the inner surface of the liber presents an amygdaloid appearance, owing to the presence of ovoid cells filled with a white substance, and imbedded in the yellowish brown tissue of the bark. Sometimes these cells are rectangular. Longitudinal and transverse sections of the bark show that these white masses are confined to the liber, and chiefly to its inner portion. In one specimen I discovered a thin layer of the white matter between the liber and the mesophlœum. These white masses I have met with more abundantly in the cinchonine barks. When the white substance is submitted to high magnifying power, it appears like a crumbling mass, without presenting any distinct crystalline form. It is readily soluble in diluted hydrochloric acid, and the solution is not precipitated by oxalate of ammonia. It dissolves also in diluted sulphuric acid; and the solution by evaporation crystallises. In alcohol, ether, and solution of caustic potash, it is only slightly soluble. It is probable, I think, that this white matter consists chiefly of some compound of the alkaloids of the bark.

5. **Markings.**—Furrows (*sulci*) are the result of the organisations of the stem, and are often nothing but scars (*cicatrices*) left by the fall of leaves and stipules, —as the circular impressions, or annular furrows (*sulci annulati*) or rings, observed on rown or Calisaya barks. Rents or cracks (*scissuræ* vel *rimæ*) are produced either by the distension of the bark during the growth of the stem, or by the drying of the bark after its removal from the stem: transverse rents or fissures from the latter cause are best seen in a false cinchona bark (*quinquina nova* of the French writers). Wrinkles (*rugæ*) are usually the result of desiccation: they give the bark a shrivelled appearance. Warts, or tubercles, (*verrucæ* vel *tuberculi*,) are observed on some barks, especially on red bark.

6. **Taste.** — A *bitter* taste is essential to all good cinchona barks, and is usually assumed to indicate the presence of an alkaloid. Experienced dealers, however, have remarked that those barks whose alkaloid is cinchonine (as C. pubescens) more rapidly communicate a bitter taste, when chewed, than those whose base is quinine. Moreover, the cinchonine barks have a more disagreeable taste, and one allied to that of sulphate of magnesia. An *astringent* or *styptic* taste indicates the presence of tannic acid; an *aromatic* taste, volatile oil or resin.

7 and 8. **Colour** and **Odour.**—Little need be said of these characters. The same kind of bark often varies in its colour, while several kinds may have the same tint. Moisture usually deepens the colour.

β. **Special Description.**—In describing the various kinds of cinchona barks, some classification or arrangement of them is desirable.

In commerce, the distinction usually followed is a *geographical* one; a bark being termed Bolivian, Peruvian, or New Granadian, according to the country of its growth. This arrangement involves, for the most part, a *botanical* one; because the barks of the several countries here referred to differ from each other essentially, on account of being the produce of different species of cinchona. But such an arrangement is objectionable, on the ground that barks do not carry with them any characters by which their geographical or botanical origin can be determined.

An arrangement founded on the *physical* (including microscopical) or *chemical* characters of barks would, if practicable, be more useful. But, at present, the difficulties which stand in the way of such arrangements are insuperable. In the last edition of this work I arranged the barks according to their colour,—a proceeding which I have subsequently ascertained to be objectionable. The same species of bark (*e.g.* the bark of *C. lancifolia*) which, in the young state, has a brown epidermis, is found, at a more advanced stage of its growth, to be whitish externally, owing to the exfoliation of its periderm, and the exposure of its white, micaceous, suberous coat. Moreover, the yellow or red colour of the liber, on which is founded the distinction of ellow and red barks, cannot be relied on for characterising any particular sort of ark; since the same species of bark may, under some circumstances, be red,—under thers, yellow. Of this we have a good example in lancifolia bark.

In a commercial point of view, the value of a cinchona bark depends on the quantity quinine which it is capable of yielding; and an arrangement of barks founded on the ture of the alkaloid which they respectively contained would be the most useful th for commercial and medicinal purposes. But though, in a general way, a bark is rmed a *quinine-bark*, a *quinidine-bark*, a *cinchonine-bark*, or an *aricine-bark*, yet cin- ona barks cannot be correctly thus classified, because most cinchona barks contain o or three of these alkaloids, and differ from each other essentially in the relative portion of these bases which they are capable of yielding. Their chemical dis- ction, therefore, is rather one of degree than of absolute difference.

In the absence of any scientific arrangement, I shall notice the barks geographical order; commencing with the more valuable barks of the thern cinchona district (Bolivia), and, proceeding northerly, finishing th the less valuable barks of the most northern cinchona district (New anada).

Bolivia	1 Calisaya (*yellow*) bark.	Ecuador	7 Loxa (*crown* and *pale*) b
Peru	2 Carabaya "		8 Guayaquil (*red* and *pale*)
	3 Cusco "	New Granada	9 Pitaya (*Condaminea*)
	4 Huanuco (*grey*) "		10 Bogota or Caqueta (*lance*
	5 Haumalies (*rusty*) "		11 Carthagena [*leaved.*)
	6 Jaen (*ash*) "		12 Maracaibo

I. CINCHONA CALISAYA[1] SEU REGIA.—ROYAL OR GENUINE YELLOW BARK.

Cinchona flava (regia), *L.*—Cinchona flava, *E. D.*

Synonymes.—*Quinquina Calisaya* ou *Jaune royal*, Guibourt. *China regia;*
nigs-China, Bergen. *China regia; Cortex Chinæ regius*, s. *flavus*, s. *luteus;* C
Calisaya, Goebel.

History.—Dr. Relph[2] says, that in a letter from a Spanish merchant at Cadiz, d
September 1789, it is observed that the *yellow bark* had only been lately known t
"The first parcel which arrived here was tried at Madrid, and was immediately bo
by the King's order for his own use." In 1790, Murray[3] first saw it at Frankfor
the Maine. He afterwards received it under the name of *cortex chinæ flavus;* a
prevent confusion he proposed to term it *royal yellow bark* (*cortex chinæ flavus*).
Relph says it was unknown in England till 1793; but this must be an erro
Murray, who died in 1791, had received it from London.

Botany.—This bark is the produce of *Cinchona Calisaya*, Weddell (see f
p. 73).—In the *Pharmacopœia Londinensis* of 1836, and in some other works, i
ascribed to *C. cordifolia*. The error arose from the circumstance of the bark o
latter, as well as of the former, species bearing the name of "yellow bark." I
attention to the error in the former editions of the *Elements of Materia Medica;*
as it has been rectified in the *Pharmacopœia Londinensis* for 1851, it need not b
ther dilated on.

Commerce.—In Bolivia there has been established a monopoly[4] in the trade o
bark, in virtue of which it can be exported only by a National Company at La
and hence the bark sold by this Company is usually known in trade as *Monopoly*
From time to time it has been found necessary to issue decrees[5] prohibiting, for a li
period, the cutting of the bark, in order to protect the bark-forests (whose exis
has been endangered by excessive cutting), and also to keep up the price of the
The effect of this monopoly has been to force the manufacturers of quinine to u
substitutes the inferior, but cheaper, quinine-yielding barks of Carabaya, Bolivia,
New Granada.

[Dr. Weddell states that the destruction of trees was so great, that the govern
tried various plans to arrest it, and at last leased the monopoly of cinchona bark t
Banco Aromayo, but this Company offered so high a price for the better sort of
that, in two years from 1849, no less than three millions of pounds of cinchona
were brought from the forests of Bolivia alone.[6]—Ed.]

Calisaya bark is usually exported from Arica, the nearest Peruvian port to the
vian district of La Paz.

Varieties and Description.—Three sorts of genuine Calisaya bark are d
guished in Bolivia: these are the *orange-coloured*, the *dark*, and the *pale*.

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[1] Weddell says that the etymology of the word "Calisaya" is very obscure. "M. Humb
[see Lambert's *Illustr.* p. 53], he adds, "believes that it is derived from the name of th
vince which produces it; but well-informed people of the country have assured me t
never existed in the province of this name. In the department of La Paz, moreover, w
is found most abundantly, it more frequently bears the name of *Colisaya* or of *Calisaya;* an
inclined to think that these names have been given to it on account of the red colour whi
external face of its denuded bark often assumes on drying, or which its leaves sometimes
For *Colli* signifies 'red' in the Quichua language; and *saya*, taken figuratively, means
or 'form.'" I prefer Humboldt's derivation, and do not see any force in Weddell's obj
to it,—for other drugs (*e.g.* Balsam of Peru, which is not the produce of Peru, but of
sonate) have been named after places which were supposed, though erroneously, to yield
Poeppig says that "*Colla*" signifies *remedy*, and "*Salla*" *rocky ground.*

[2] *Inq. into the Med. Effic. of Yellow Bark*, 1794.

[3] *Apparatus Medicaminum*, vi. 178.

[4] See *Pharmaceutical Journal*, vol. xi. p. 215, 1851.

[5] See the 2d ed. of these *Elements* (p. 1376) for a copy of the decree issued in 1837
the *Pharm. Journ.* (vol. xi. p. 218) for a copy of the decree issued in 1850.

[6] *Pharm. Journ.* vol. xiv. p. 133.

1. *Orange-coloured Calisaya bark.* — This is called in Bolivia *Calisaya amarilla*, *C. dorada*, or *C. anaranjada* (yellow, golden, or orange-coloured Colisaya). It is the sort most frequently met with in commerce.

In commerce, two kinds are distinguished: the *quilled* and the *flat.*

α. *Quilled yellow bark* (*cinchona flava regia tubulata* seu *convoluta*). — The quills vary in length from three to twenty-four inches; in diameter, from two lines to one and a half or even two inches; in thickness, from half to six or seven lines. Very small quills, however, are rare; those usually met with having a diameter of from one to one and a half inches, and a thickness of from three to six lines. Sometimes they are doubly, though in general they are singly, quilled.

Quilled yellow bark is usually *coated;* but occasionally we meet with quills which are more or less *uncoated.* Some of these uncoated quills somewhat resemble coarse cassia lignea. (*Cinnamon-like Calisaya quills*). Are they the produce of *C. Calisaya*, var. β *Josephiana?* They agree in appearance with the latter; and Mr. J. E. Howard tells me that he suspected this origin of them on account of their stypticity (see. p. 91).

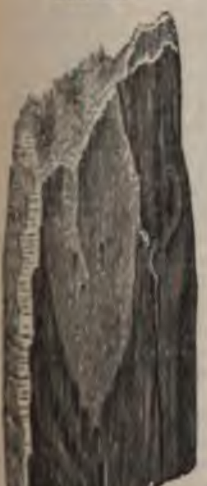
The periderm or coat varies in its thickness.[1] It is more or less rugous, and is marked with transverse impressions or furrows or cracks, which often form complete circles or rings around the quills, and whose edges are thick, raised, and everted. When the periderm is very thick, its substance acquires a corky or elastic consistence, and the annular furrows assume the appearance of deep incisions. Between these rings there are longitudinal wrinkles and cracks. These furrows and cracks, in the coarser quills especially, give the bark a very rough or rugous character, by which it may generally be readily distinguished from the large quills of Huanuco or grey bark. The periderm is almost insipid. Its colour is naturally brown, but it is often rendered more or less silvery or grey by the crustaceous lichens with which it is covered.

The derm or uncoated portion consists chiefly of liber, whose taste is very bitter and but slightly astringent. Its transverse fracture is resinous externally, and fibrous internally. Externally it is brown, and is marked with impressions corresponding to the furrows or cracks of the periderm. Internally it is finely fibrous, and has a deep cinnamon-brown colour.

Fine large-coated quills are sometimes selected for filling druggists' show bottles.

β. *Flat yellow bark* (*cinchona regia plana*). — The pieces of this sort are from eight to fifteen or eighteen inches long; from one to three inches broad, and from one to five lines thick. They are but little curved or arched; occasionally the inner surface is slightly convex, and the outer one concave from drying. In general the pieces are uncoated (*cinchona regia nuda*), and then consist almost solely of liber, which sometimes has a thickness of one-third or even half of an inch. This derm or liber has considerable density, usually a perfectly uniform texture, and on the external surface is marked by longitudinal digital furrows,[2] which are more or less confluent and separated from one another by projecting ridges. The colour of its external surface is slightly brownish tawny yellow, frequently with blackish-red patches. The internal surface is fibrous, often with an undulating grain, of a yellowish tawny colour, sometimes with an orange tint, especially when the bark is fresh. The transverse fracture is purely and uniformly fibrous, the fibres being short and readily detached, and irritating the skin like the hairs of Dolichos pruriens. The longitudinal fracture is without splinters, and presents a surface covered with brilliant points, owing to the

FIG. 24.



Bark of C. Calisaya entirely deprived of periderm.

(This figure shows the digital furrows, and the short fibrous fracture of the liber.)

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[1] It is not uncommon to find pieces whose periderm is $\frac{4}{10}$ths of an inch thick.

[2] Weddell calls them *sillons digitaux*, because they are somewhat like the impressions produced by the tips of the fingers on soft paste or clay. The Spaniards term them *conchas*, on account of their fancied resemblance to the hollows of certain shells.

reflection of light from the denuded fibres, and of a uniform colour. Its taste is very bitter, — the bitterness being gradually developed on mastication, — with scarcely any astringency.

2. *Dark Calisaya bark.* — This is called *Colisaya zamba*, *C. negra*, or *C. macha* (sambo, black, or male Colisaya). It is remarkable for the dark tint of its external surface, which is often of a vinous black. Weddell met with it especially at Apolobamba, and in the province of Carabaya in Peru.

3. *Pale Calisaya bark.* — This is termed *Colisaya blanca* (white Colisaya). It is less unequal on the surface, sometimes semi-cellular, and of a paler colour.

DIAGNOSIS. α. *Physical.* — The periderm or coat is brown internally[1], deeply furrowed or cracked transversely or circumferentially so as to form rings, wrinkled longitudinally, and in the older branches, brittle and readily detached. The derm or liber is of a uniform orange or cinnamon brown; yields slowly, when masticated, an intensely bitter, very slightly astringent taste; and breaks with a fibrous fracture which is equal internally and externally. The external surface of uncoated flat pieces is marked by digital furrows.

Barks whose periderm is white or micaceous, or red, or which is devoid of the transverse or angular furrows or cracks, are not genuine Calisaya barks. Those barks whose derm or liber has an ochry or very red tint, or which presents two distinct colours (a whitish one internally and a reddish one externally), or whose fracture is more fibrous internally than externally, are suspicious.[2]

" The best characters," says Dr. Weddell, " by which the true Calisaya may be distinguished from every other species, are — the shortness of the fibres which cover the whole surface of its transverse fracture, and the facility with which they may be detached instead of being flexible and remaining adherent, as is the case with the barks of *rufinervis* and *scrobiculata*. Lastly, its uniform dull yellow (tawny) colour, and its substance not being marbled with white, readily distinguishes it from *C. Boliviana*.

" Add to these characters its great density (which is such that when a nail is drawn across it, a bright mark is left): the depth of the digital furrows and the prominence of their separating ridges are generally sufficient to distinguish the flat Calisaya from all the other barks with which it may be mixed.

" The quilled Calisaya is more difficult to distinguish, because its periderm, in its physical characters, greatly resembles several other species, especially *scrobiculata* and *rufinervis*; and also because the fracture does not present the same clear characters which it does in the older barks." To these characters we must add the degree of bitterness, which, in doubtful cases, is the most sure method of deciding the question.

β. *Microscopical.* — " If we resort to the microscope to aid us," says Dr. Weddell, " the characters by which the bark is to be distinguished are very slight; namely, a slight excess in the thickness of the periderm, and the broader resinous circle." If we examine by the microscope a transverse section of this bark (see figs. 25 and 26), we observe that the texture is homogeneous, and consists of ligneous fibres uniformly distributed in cellular tissue filled with resinous matter. This tissue is interposed between the fibres so as almost to isolate them. If we examine a longitudinal section of the liber (see fig. 27), it will be seen that the ligneous fibres are short and fusiform, and their obliquely truncated extremities are only loosely adherent to, or are even completely independent of, those next to them.

γ. *Chemical.* — It is doubtful whether there are any chemical means of distinguishing this from other allied cinchona barks. Anthony[3] gives the following: — Digest one part of finely-cut bark in four parts of boiling distilled water for twelve hours; then filter. This infusion yields with reagents the following results: — Dilute liquor ammoniæ (sp. gr. 0·990) renders it turbid, and occasions a precipitate: neither a solution of iodide of potassium (one part iodide and six parts water) nor a saturated solution of nitrate of baryta occasions any change in it: lastly, solution of fresh-made sulphate of protoxide of iron (one part sulphate and six parts water) colours the infusion green, but does not, within four hours, occasion any precipitate. According to Anthony, these results taken together characterise Calisaya bark, and distinguish it from all other cinchona barks.

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[1] Externally it may be variously coloured by lichens.

[2] See, on this subject, Guibourt, *Journ. de Pharm.* t. xxii. p. 614, 1836.

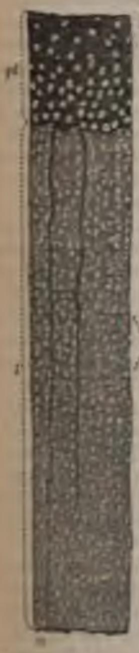
[3] Buchner's *Repertorium*, Bd. iv. S. 54, 1835; and Bd. vi. S. 58, 1836.

Guibourt[1] uses sulphate of soda to distinguish Calisaya from Loxa and Lima barks: —Coarsely pulverise the suspected bark, and rub the powder in a mortar, so as to form a thin paste, which is to be placed on a filter. Add some crystals of pure sulphate of soda to the filtered liquor: if the bark be the Calisaya sort, a white precipitate is obtained; but if it be a grey bark this effect does not take place.

The following are the characteristics of Calisaya given in the *Pharmacopœia Londinensis* for 1851: —

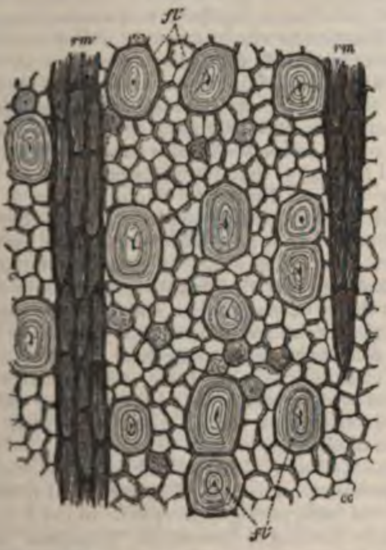
"Thick, chiefly composed of very slender acute fibres, either flat or quilled: the external surface of the latter ash-coloured or brownish, wrinkled longitudinally, deeply fissured transversely or circumferentially: the former denuded for the most part, and of a cinnamon-brown colour. Very bitter. From a pound of this bark should be obtained, by means of sulphuric acid, about three drachms of disulphate of quina." —*Ph. Lond.*

FIG. 25.



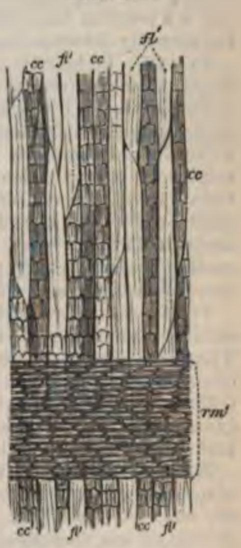
Transverse section of the entire thickness of a piece of bark with a portion of the periderm attached.

FIG. 26.



Transverse section of a portion of the liber (much more highly magnified than in fig. 25).

FIG. 27.



Longitudinal section of a portion of the liber made parallel to the medullary rays.

Microscopic structure of Calisaya bark.

pd, Portion of periderm.
l, Liber.
cc, Cellular tissue of the liber.
fl, Ligneous fibres of the liber (cortical fibres).
rm, Medullary rays.

CRYPTOGAMIA. — The following is a classified list of cryptogamic plants found on this bark, according to Fée:[2] —

1. Fungi. — *Hypochnus rubrocinctus; Triclinum Cinchonarum.*

The first of these fungi is frequently met with on quilled yellow bark. Its receptacle is irregular in shape, scarlet, with a whitish surface.

2. Lichenes. — The crustaceous or adherent lichens are — *Opegrapha peruviana; O. Scaphella; O. ovata; O. rhizocola; Graphis cinerea; G. cinnabarina; Arthonia obtrita; Fissurina Dumastii; Chiodecton sphærale; Trypethelium verrucosum; T. chiodectonoides; Pyrenula annularis; Porina americana; Ascidium Cinchonarum; Lepra*

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[1] *Journ. de Pharm.* t. xxii. p. 614, 1836.

[2] *Cours d'Histoire Naturelle*, t. ii. p. 262, 1828.

flava; Variolaria amara; Lecidea aurigera; L. tuberculosa; L. soredifera; and *L. punicea.*

The foliaceous lichens are—*Parmelia perlata; Sticta macrophylla; Collema azureum;* and *Solorina vitellina.*

The filamentous or hairy lichens are—*Usnea florida* and *U. barbata.*

3. Hepaticæ.—*Jungermannia atrata.*

4. Musci.—*Hypnum Langsdorfii.*

COMPOSITION.—Deschamps[1] discovered in this bark the salt which he termed the *quinquinate of lime*, but which is now called *kinate of lime.* In 1820, Pelletier and Caventou[2] analysed this bark, and found in it *superkinate of quinine, kinate of lime, red cinchonic, soluble red colouring matter* (tannin), *fatty matter, yellow colouring matter, lignin,* and *starch.* At first they thought this bark contained no other vegetable alkaloid than quinine, but they afterwards[3] discovered cinchonia in it. In 1829, Sertürner[4] announced the existence of a third alkaline base in it, to which he gave the name of *quinoidine.* In 1846, Liebig[5] declared this to be *amorphous quinine;* and still more recently, Van Heijningen[6] has resolved it into four or five different substances, of which one is a peculiar base called *quinidine* or *β-quinine*, and another *γ-quinine.*[7] Schwartz[8] has recently detected both *kinovic* and *cincho-tannic* as well as *kinic acid* in this bark.

In 1827, Pelletier[9] consumed 2,000 quintals of this bark in the manufacture of 90,000 ounces (French) of disulphate of quinine : this is about three drachms of disulphate for one lb. of bark. Soubeiran[10] states that one lb. (French) of *uncoated yellow bark* yields three drachms and from 30 to 50 grains (French) of disulphate of quinine; while the same quantity of *coated yellow bark* yields three drachms (French) of the disulphate. It may be stated generally, that 100 parts of yellow or Calisaya bark yield from 3 to 3½ per cent. of crystallised disulphate of quinine; or, 2 lbs. avoird. of bark yield nearly 1 oz. avoird. of the crystallised sulphate. Assuming that this sulphate contains 74·3 per cent. of pure quinine, it follows that 100 parts of Calisaya bark contain from 2⅕ to 2⅗ parts of pure quinine. I have heard that as much as 4 per cent. of disulphate of quinine has been obtained from one sample of Calisaya bark.

Puttfarcken[11] states that this bark yielded him only 0·58 per cent. of ashes, being a smaller amount than he obtained from any other either genuine or false cinchona bark. The ashes were of a green colour (owing to manganate of potash). The per-centage of carbonate of lime and of caustic lime in the bark were respectively (on the average) 0·45 and 0·25,—proportions which were smaller than in any other cinchona barks examined, and seem to favour the notion that with the increase of the alkaloids in the barks the proportion of lime diminishes.

MEDICINAL PROPERTIES.—Yellow or Calisaya bark, on account of the large quantity of quinine which it yields, possesses more powerfully tonic and febrifuge qualities than any other cinchona bark,—red bark, perhaps, excepted. In the London Pharmacopœia of 1851, it has, therefore, been directed to be used as "*Cinchona*" when the particular sort is omitted to be specified in the preparation of *Decoctum Cinchonæ, Extractum Cinchonæ, Infusum Cinchonæ, Infusum Cinchonæ spissatum,* and *Tinctura Cinchonæ.*

Considered as an astringent, yellow bark is inferior to some other sorts of Cinchona, on account of its containing a smaller proportion of tannic acid (Pelletier and Caventou).

PSEUDO-CALISAYA BARKS.

Under this name I include various barks, both quilled and flat, which are more or less allied to or simulate the genuine Calisaya sort and are known to the dealers as

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[1] *Ann. Chim.* t. xlviii. p. 65.

[2] *Journ. de Pharm.* t. vii. p. 89, 1821.

[3] *Ibid.* t. vii. p. 302, 1821.

[4] Buchner's *Repertorium,* Bd. xxxii. S. 95, 1829.

[5] *Lancet,* p. 585, May 23, 1846; *Ann. d. Chem. u. Pharm.* Bd. lviii. S. 348, 1846.

[6] *Pharmaceutical Journal,* vol. ix. p. 322, 1850.

[7] *Ibid.* vol. xi.

[8] *Ibid.* vol. xii. p. 17, 1851.

[9] *Dict. Mat. Méd.* t. v. p. 603.

[10] *Traité de Pharm.* t. i. p. 583.

[11] *Pharmaceutical Journal,* vol. xi. p. 129, 1851.

false or *spurious Calisaya barks.* They are imported from Bolivia and Peru, and, except in one instance (that of *C. scrobiculata var. β Delondriana*), are not known to the London dealers by any special names to distinguish them from one another. In France, the term *Calisaya léger* (light or flimsy Calisaya) has been applied to some of them. From Germany I have received one of them (*C. micrantha*) under the name of *cortex chinæ pseudo-regius.* From Sweden I received, as a genuine Calisaya bark, the bark of *C. amygdalifolia.* I have very little doubt, therefore, that on the Continent, as well as in this country, they frequently pass as the genuine Calisaya sort.

They are imported either alone or intermixed with genuine Calisaya bark. The intermixture, says Dr. Weddell, is especially made in Bolivia with the barks of *C. Boliviana* and *C. ovata var. β rufinervis;* and only on the coast with *C. scrobiculata.*

Under the general head of Pseudo-Calisaya barks I include —

1. The barks of *C. Calisaya var. β Josephiana* and of *C. Boliviana:* the former perhaps strictly entitled to the name of a genuine Calisaya bark, — and the latter bearing the name of Calisaya bark in Bolivia.

2. The barks of *C. ovata var. β rufinervis*, *C. micrantha*, *C. amygdalifolia*, and *C. scrobiculata var. α genuina* and *var. β Delondriana.*

M. Guibourt mentions several other barks (for example, *C. pubescens var. α Pelletieriana*, and *C. cordifolia*) as being used for adulterating the Calisaya sort. But inasmuch as they differ considerably in appearance from the latter, and are distinguished in trade, by *Cusco bark: Carthagena bark:* special names, as distinct sorts, I have not included them under the general head of Pseudo-Calisaya barks, but shall describe them separately hereafter.

1. *C. Calisaya var. β Josephiana.*

BARK OF C. JOSEPHIANA. — The shrub called by the Peruvians *Ichu Cascarilla*, which yields this bark, being considered by Weddell to be a variety of C. Calisaya, its bark must rank as a sort of Calisaya, though in appearance it differs considerably from the genuine Calisaya bark. The bark both of the stems and of the wood is found in commerce.

1. *Stem-bark.* — Weddell observes of it, that though it rarely occurs in commerce, yet by the natives it is used as often as any other bark, in consequence of the facility with which it is procured. Its periderm (or coat), he adds, is brown or blackish-grey or slate-coloured (a colour common to all cinchona barks developed under the influence of wind and sun), and is covered by pale elegant lichens. As the bark adheres strongly to the wood, it is separated with difficulty from the latter; and to this circumstance is to be attributed the fact that the internal surface of this bark is often torn. The *cinnamon-like Calasaya quills* before alluded to (p. 87) are exactly like some recently sent to Dr. Weddell as *Ichu-Cascarilla.*

2. *Root-bark.* — Weddell was shown in Peru the bark obtained from the larger roots, or rather stumps, of C. Josephiana. He describes it as being in short, flattened, undulated, or more or less contorted pieces, deprived of the periderm, fibrous or almost smooth on the inner surface, very slightly cellular, externally of a uniform ochre-yellow colour, and decidedly bitter, but less intensely so than good Calisaya, whose internal structure it possesses the characters of.

Weddell suggests that this root will become valuable, notwithstanding the difficulty of collecting it, as it is superior to some of the barks at present in use, and has not hitherto been much employed. A root-bark, apparently the one in question, has been imported into England by way of the Pacific, and found to yield quinine, but in very small quantity.

New Granada Cinchona root-bark. — There is a root-bark of a species of cinchona, imported from New Granada by way of Santa Martha and Maracaibo, which must not be confounded with the root-bark of C. Josephiana. In its curly or twisted or contorted character, it much resembles the latter; but it yields cinchonine, — whereas the root-bark of C. Josephiana yields quinine.

2. *C. Boliviana.*

CORTEX CINCHONÆ BOLIVIANÆ, Weddell; *Calisaya morada*, Boliv.; *Cascarilla verde morada*, Peru; *Bark of the Mulberry-coloured Calisaya.* — This constitutes part of the Calisaya bark of commerce. It occurs both quilled and flat, and greatly resembles the genuine Calisaya, from which it is with difficulty distinguished; but its fibre is somewhat coarser, and more easily reduced to powder. Its taste is bitter, with a somewhat smoky flavour. The fractured surface presents, when quite fresh, paler or whitish patches, which, however, become at first red and afterwards brownish-yellow in the air. The periderm or coat is less thick, and its fissures less marked than in the genuine Calisaya. *Quilled Boliviana bark* is quite similar to quilled Calisaya. *Flat Boliviana bark* is composed solely of liber. It is in general equally dense but thinner than flat Calisaya. The digital furrows are shallower, a little more confluent, and the separating ridges more rounded. Its colour is brownish fawn yellow, with somewhat greenish tints in some places.

3. *C. ovata var. β rufinervis.*

CORTEX CINCHONÆ RUFINERVIS; *Cascarilla Carabaya; Cascarilla zamba morada*, Peruv.; *Dark Mulberry-coloured Calisaya.*—Dr. Weddell states that in the province of Carabaya, where this bark is collected, it is habitually used to sophisticate Calisaya bark, from which it is frequently very difficult to distinguish it. In the quilled variety, called by Dr. Weddell *pseudo-Calisaya*, the periderm exfoliates very readily. The flat pieces consist either of liber only, or of liber with a portion of the cellular coat. The fibre is finer and closer than the Calisaya sort; and the external surface presents darkish spots due to the remains of the cellular crust filled with a brown juice. "I have seen," says M. Guibourt, "a manufacturer of sulphate of quinine complain much at having been deceived by the appearance of this bark."

4. *C. micrantha.*

CORTEX CINCHONÆ MICRANTHÆ.—By the inhabitants of Huanuco it is called *Cascarilla provinciana*: in the province of Carabaya, it is termed *Cascarilla motosolo*, and, by the Bolivians, *Quepo-Cascarilla* or *Cascarilla verde*. In Carabaya, where it is extensively collected, it is confounded with the ordinary forms of C. ovata, under the name of *Cascarilla morada ordinaria.*

It is obvious to me that either this bark puts on several very dissimilar forms, or that the bark of several distinct species are confounded together under the same name. M. Guibourt appears also to have arrived at a somewhat similar conclusion; for, after describing two sorts of micrantha bark, he observes that it appears to him that they are not the produce of Poeppig's *micrantha*, which, therefore, cannot be identical with that of Weddell.

The *quilled* micrantha bark, according to the statements of Poeppig and Reichel, constitutes part of the Huanuco or grey bark of commerce. Its characters, as given by Weddell, are as follows: periderm very thin, adherent, slightly wrinkled longitudinally as if shrivelled, or very slightly warty, bright brownish grey, marbled with some deeper tints. Derm almost smooth externally, finely fibrous, and of a bright orange-fallow internally. Transverse fracture short externally, fibrous internally. Bitterness very marked and rapidly developed.

The *flat* micrantha simulates genuine Calisaya, but is less dense. It consists either of liber only, or of the liber and cellular tissue: the latter is usually semi-fungous and imperfectly exfoliated. The external surface frequently presents concavities or superficial digital furrows like those of Calisaya bark, and separated by irregular suberous elevations; much more rarely smooth by the persistence of the whole of the cellular coat; of a greyish and bright orange-yellow colour. Internal surface is remarkably fibrous,[1] and of a brighter tint than the external one. Transverse fracture stringy throughout the whole thickness of the bark,—or somewhat suberous externally. Longitudinal fracture a little splintery, with a dullish surface. Taste very bitter, speedily developed, a little piquant, scarcely styptic.

In rather aged barks, Weddell observes that the periderm is not very thick, and appears to be entirely formed of the suberous coat; but between this external layer and the derm there is frequently found a reddish pulverulent matter, of which it is in part made up, and which results from the decomposition (not desquamation or exfoliation, as in other species) of this part.

Poeppig says that three kinds of micrantha bark are known in trade; but he does not specify them.

M. Guibourt includes Weddell's flat micrantha bark under his *orange-yellow bark* (quinquina jaune orangé), and observes that its exterior surface is, as it were, greenish, is marked with transverse impressions and oval cavities filled with some fungous matter, and presents asperities and inequalities not met with in any other sort.

5. *C. scrobiculata.*

CORTEX CINCHONÆ SCROBICULATÆ.—The barks of the two varieties of *C. scrobi-*

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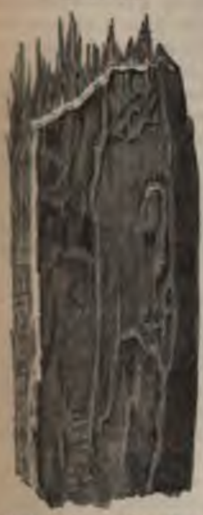
[1] The fibrous grain of some of the flat pieces is remarkably wavy or undulating.

culata are not distinguished by Weddell; but the specimens which I have in my possession are very distinct.

FIG. 28.



Bark of C. scrobiculata. Stringy fracture of liber.

If we examine a piece of flat scrobiculata bark, we shall find, says Dr. Weddell, that instead of the digital furrows with a fibrous bottom, which characterise Calisaya bark, it presents a surface almost even, and consisting of cellular tissue, traversed here and there by a slight linear impression; the inner surface being, as in Calisaya bark, of a fibrous texture. The transverse fracture is more or less suberous or fungous externally, according to the thickness of the cellular coat; and very fibrous or stringy internally; the fibres being long and pliant.[1]

When a transverse section of the bark is submitted to microscopic examination, we observe that the fibres are more numerous than in Calisaya bark, and are nearer the inner surface; but they lessen in number rapidly towards the outer or epidermoid surface, and the outermost layer is almost devoid of them. To this circumstance is due the fact that the transverse fracture is more fibrous internally than externally (fig. 28). The cortical fibres, instead of being free or isolated, in the midst of cellular tissue, touch each other, and adhere by one of their surfaces with neighbouring fibres to form parallel series (figs. 29 and 30); and if we examine a longitudinal section (fig. 31) of the liber by the microscope, we observe that these fibres are nearly twice as long as those of C. Calisaya (fig. 27), and their extremities are always attached to those of neighbouring fibres, so that the oblique truncations are more elongated (fig. 31). To this peculiarity of the fibres is due the more fibrous or stringy transverse fracture of this bark.

FIG. 29.

Transverse section of the bark completely deprived of its periderm.

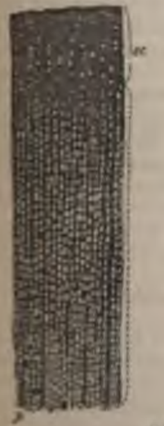


FIG. 30.

Transverse section of the liber (more highly magnified).

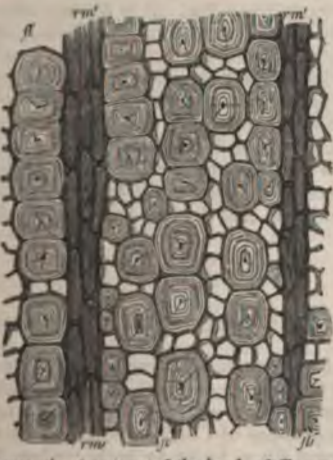
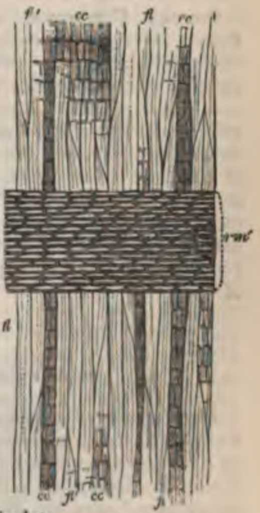


FIG. 31.

Longitudinal section of C. scrobiculata, parallel to the direction of the medullary rays.



Microscopic structure of the bark of C. scrobiculata.

Fig. 29 shows the analogy which exists between the external layer (*ec*) of this bark, and the internal layer of the periderm of the Calisaya bark (fig. 25).

cc, Cellular tissue of the liber.
ec, Cellular envelope.
fl', Ligneous or cortical fibres of the liber.
rm', Medullary rays.

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[1] The best method of rendering these fibres evident is to effect the fracture by torsion (Weddell).

1. *Cortex C. scrobiculatæ var. α genuina.*—This bark is called in Peru *Cascarilla colorada del Cuzco* (i. e. Red Cusco Bark), or *Cascarilla de Santa-Ana* (i. e. St. Ann's Bark). This is one of the barks which Guibourt terms *Calisaya* léger (i. e. Light or Flimsy Calisaya). I have met with it in English commerce under the name of *Cusco bark.* It occurs in flat pieces composed of the liber covered externally by a thin layer of the cellulo-resinous tissue. My specimens are readily distinguishable from Calisaya bark by their fresher or brighter colour; but Weddell states that the colour of this bark is very variable. The external or cellulo-resinous surface is brick-red or purplish-red, or within reddish-orange; marked by superficial transverse impressions or furrows. The internal surface (of the liber) is of a fine reddish-orange colour. Fracture more or less short or suberous externally, according to the thickness of the cellular coat; fibrous or stringy internally: the colour of the fractured surface is not uniform. Taste both astringent and bitter. The reddish colour of this bark explains why it is called *red bark* (Cascarilla colorada) in Cuzco, and why De Candolle thought C. scrobiculata was the source of the red bark of commerce. Guibourt states that if this bark be isolated in a bottle it evolves an agreeable raspberry-like odour.—This bark is imported both unmixed and mixed with Calisaya.

2. *Cortex C. scrobiculatæ var. β Delondrianæ.*—This bark is imported from Lima, and is known in English commerce by the name of *Peruvian Calisaya.* It occurs in flat pieces which in colour closely resemble the genuine Calisaya bark, for which it is often passed off. They are thicker and denser than the Cascarilla de Santa-Ana, from which they also differ in colour. Externally this bark is smoother than the Calisaya bark, and the ridges between the furrows are smoother and rounded,—not sharp, as in the bark just mentioned. The fracture is fibrous: the taste, in the larger pieces, less bitter than that of Calisaya bark.

The younger quilled and coated scrobiculata bark probably constitutes part of the crown bark of commerce, with which it agrees in chemical constitution.

Weddell states that 1000 parts of the scrobiculata bark yield only from 7 to 8 parts of sulphate of cinchonine, and from 3 to 4 parts of disulphate of quinine; and he adds that the large quantity of red colouring matter which it contains is a great impediment to its use for manufacturing purposes.

6. *C. amygdalifolia.*

CORTEX CINCHONÆ AMYGDALIFOLIÆ; *Cascarilla-echenique*, Peruv.; *Cascarilla-Quepo*, or *Qurpo-Cascarilla*, Boliv.—It is imported, either alone or mixed with other Bolivian barks, both quilled and flat. It is distinguished from genuine Calisaya bark by its lightness, its more orange colour, the presence of the persistent cellular coat in the so-called uncoated pieces, the more stringy transverse fracture and the splintery longitudinal fracture of the liber, the want of very marked annular cracks on the periderm, and the styptic usually not very bitter taste. The flat pieces consist of liber and cellular coat, oftentimes more or less covered by the periderm: externally it is smooth, or superficially wrinkled longitudinally by drying. A portion of the quilled sort, which had been identified by Dr. Weddell, yielded Mr. J. E. Howard 7 parts of quinidine and a trace of cinchonine in 1000 parts of bark. The flat pieces yielded him 2·3 parts of quinidine, and the like quantity of cinchonine, in 1000 parts of bark.

II. CORTEX CINCHONÆ DE CARABAYA—CARABAYA BARK.

Carabaya or *Caravaya bark* was first imported into London in 1846. Its name would lead to the suspicion that it was obtained from Weddell's *Cinchonas carabayensis:* but such is not the case. According to information furnished by Dr. Weddell to Mr. J. E. Howard, it is the produce of *Cinchona ovata var. α vulgaris.* "Dr. Weddell assured me," says Mr. Howard (in a letter to me), "when here this spring [1852], that it was *var. α vulgaris*, and his specimens given me include it. The *rufinervis* bark, which he has also given me, is a distinct variety." It is obvious, however, that Carabaya bark is very different in appearance, and even in chemical composition, from the bark usually known as the produce of the ordinary variety of *C. ovata.* Moreover, in Peru, the name of *Cascarilla Carabaya* is given to *C. ovata var. β rufinervis;* so that the designation of "Carabaya bark" is not a very precise one. I apply it, however, exclusively to the bark known by this name in the London market, and which is tolerably uniform in its properties.

Carabaya bark is imported from Islay, the nearest port to the province of Carabaya, in which the bark is collected. Large importations of it are now made into London. It is essentially a thin flimsy bark, of a more or less rusty colour; some of the pieces resembling in appearance *Huamalies bark*, from which, however, it appears to be essentially different. The quills are about the thickness of the finger, and of variable length. I have some which are two feet long: some are coated, others are uncoated quills. The coated quills (*coated Carabaya quill*) have a dull, rusty or greyish rusty, warty coat, marked by longitudinal furrows, but rarely by transverse furrows or cracks. Some of the uncoated quills have a dark or more or less tea-green tint (*tea-green Carabaya quill*). The flat pieces (*flat Carabaya*) consist either of liber only, or of liber with a portion of the cellular coat. The external surface of the liber, in some of the uncoated pieces, is blackish, with rusty round flattish warts. In some cases the dark external surface looks as if it had been dusted over with a yellowish powder (*e. g.* powder of gamboge or turmeric), by which a kind of bloom has been given to it. The colour of the liber is usually more or less orange; but some pieces resemble in colour red bark (*red Carabaya bark*). Carabaya bark is used by the manufacturers of sulphate of quinine as a cheap substitute for the more valuable Calisaya bark. The total amount of alkaloids (cinchonine, quinidine, and quinine) which it yields, is from three to four per cent.

III. CORTEX CINCHONÆ DE CUSCO. — CUSCO BARK.

Under the name of *Cusco* or *Cuzco* bark, I have met with, in English commerce, several very distinct barks, viz. 1st. The bark of *Cortex Cinchonæ scrobiculatæ var.* α *grassina*, known in Peru as Red Cusco bark, and which has been already noticed (see *ante*, p. 94. 2ndly. The bark of *Cortex pubescens var.* α *Pelletieriana.* As the last-mentioned bark is the one which was first known in Europe as Cusco bark, and which is usually indicated by this designation in pharmaceutical works, I shall continue to call it by this name. 3rdly. I have also received under the name of "Cusco bark," specimens of a quilled bark, and also of a flat bark, which I believe to be the produce of *C. ovata* (see *Cortex Cinchonæ de Jaen*).

Cusco bark, or the bark of *C. pubescens var.* α *Pelletieriana*, was first introduced into Europe in 1829 as yellow or Calisaya bark. It appears to have been imported at about the same time into England, Hamburg, and Bordeaux.[1] Bergen[2] called it *rusty bark* (*China rubiginosa*), on account of its rusty yellow colour. The bark described in 1829 by Pelletier and Coriol,[3] under the name of *Arica Bark* (*écorce d'Arica; quinquina d'Arica,*) is a variety of it.

Weddell has ascertained that this bark is the produce of *Cinchona pubescens.* The var. α *Pelletieriana* yields Pelletier's *Arica bark*, which, by the Bolivians and Peruvians, is called *Carua-Carua* or *Cargua-Cargua*, and in Carabaya it is sometimes termed *Cascarilla amarilla* or *Quina amarilla* (yellow bark), the name which Mutis gave to the bark of C. cordifolia. The bark of var. β *purpurea* is called, in the valleys about Huanuco, *cascarilla bobo de hojas moradas*, or "spurious bark with mulberry leaves."

The bark of C. pubescens is never entirely devoid of its external cellular coat; and hence, when fractured transversely, this coat breaks smooth or corky, while the liber presents a short fibrous or ligneous fracture. In this bark the periderm consists only of some rows of the cubical cells of the suberous coat. If we submit sections of the bark to microscopic examination, we observe that the portion of the suberous coat which remains adherent to the bark is membraniform, and consists of cubical or rectangular cells (fig. 33 *s*). The limits of the cellular envelope and the liber are less clearly defined in this bark than in the others before figured. The cells of the cellular envelope, however, are more flattened in the direction from without inwards than those of the liber. The greater part of the transverse section (fig. 33) of the bark is seen to consist of cellular tissue, in which the fibres form but a small number of irregular and concentric series in the inner half of the bark. A very remarkable circumstance is the size of the fibres, which are frequently three or four times as large as those of Calisaya or scrobiculata bark before figured (see *ante*, figs. 25 to 31). Bundles of these fibres, united together laterally, are arranged in zones in the midst of the cellular tissue of the bark (figs. 34 and 35).

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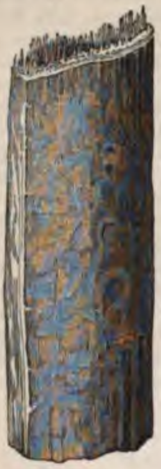
[1] Jobst, Buchner's *Repert.* Bd. xxxii. S. 464, 1829; Guibourt, *Journ. de Chem. Méd.* t. vi. p. [illegible], 1829.

[2] Buchner's *Repert.* Bd. xxxviii. S. 9, 1839.

[3] *Journ. de Pharm.* t. xv. p. 565, 1829; also, *Ann. de Chim. et de Phys.* t. li. p. 184.

FIG. 32.



Bark of C. pubescens coated externally by periderm.

Smooth or suberous fracture of the external or purely cellular portion of the bark.
Ligneous fracture of the internal portion or liber.

Bergen observes, that Cusco bark somewhat resembles what is called fibrous Carthagena bark. It varies in appearance according to its age: but in general its orange-red or rusty colour, the remains of the white or greyish suberous coat, and the absence of transverse cracks, serve to distinguish it. The young quills are coated, thin, externally smooth, and of an almost uniform yellowish-grey colour; on the inner surface they are yellowish, and have a fibrous texture. The middling-sized quills are covered by a whitish, smooth, uncracked, suberous coat, beneath which is an orange-red cellular envelope. The inner surface of the liber is dull yellowish cinnamon brown. The cortical fibres are coarse and pale, but become red by exposure to the air. The larger and flat pieces consist of the liber covered externally by the cellular envelope, with the remains of some portion of the suberous coat. By inexperienced persons they may be mistaken for yellow (Calisaya) bark. "They may be readily distinguished," says M. Guibourt, "by their more regularly cylindrical form, by their smoother external surface, by the remains of the white and fungous layer, by their two tints of colour, orange or brownish externally, almost white or very pale internally, and, lastly, by their not occasioning any precipitate with sulphate of soda."

FIG. 33.

Transverse section of the bark of C. pubescens.

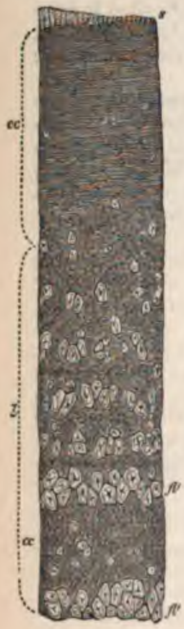


FIG. 34.

Transverse section of the liber of C. pubescens (more highly magnified than in fig. 346).

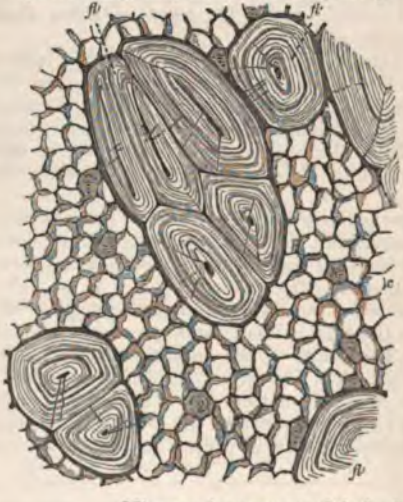
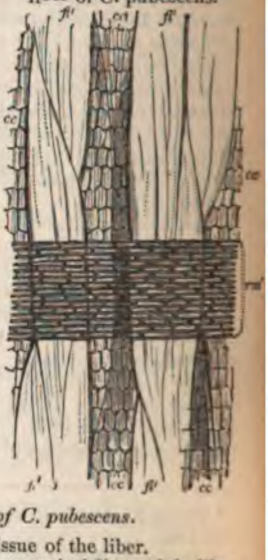


FIG. 35.

Longitudinal section of the liber of C. pubescens.



Microscopic structure of the bark of C. pubescens.

s. Suberous coat.
ec. Cellular envelope.
l. Liber.
cc. Cellular tissue of the liber.
fl. Ligneous or cortical fibres of the liber.
rm. Medullary rays.

This bark was analysed by Frank,[1] who obtained, in one experiment, 48 ounces of cinchonine, and a trace of quinine, from 100 lbs. of bark. In another trial he procured 50 ounces of cinchonine from the same quantity of bark. Winckler[2] reports, that he got 256 grains from 16 ounces of the best heavy sort of *rubiginosa* bark, and only 77 grains from the same weight of an inferior sample of the bark. M. Guibourt[3] examined a kilogramme (about 2 lbs. 3 oz. avoird.) of Cusco bark, and estimates the quantity of cinchonine contained in it at one drachm for every pound of bark. He observes, that the bark is very rich in red cinchonic. Some of the pieces, according to Bergen, are very rich in resin.

ARICA BARK; *Ecorce d'Arica*, Pelletier; *Quinquina d'Arica.*—The bark which, in 1829, Pelletier and Corriol analysed under this name, appears to be essentially Cusco bark. It differs, however, says M. Guibourt, a little from the ordinary Cusco bark, though it constitutes a part of it. According to Pelletier, Arica bark becomes deep green when touched by nitric acid, and yields, on analysis, an alkaloid (*aricina*), which acquires an intensely green colour when dissolved in concentrated nitric acid, and which forms, with sulphuric acid, a sulphate, not crystallisable from its aqueous solution, but forming a white, trembling, gelatiniform mass. In 1830, I procured from M. Pelletier a specimen of his Arica bark (which is now in the Museum of the Pharmaceutical Society), but it is not rendered green on the application of nitric acid. "The bark analysed by Pelletier," says M. Guibourt,[4] "does not become coloured by nitric acid; and I am now at liberty to state, that Pelletier, having requested me to return him the greater part of the Arica bark which he had previously given me, in order that he might verify the characters which he no longer found in that which remained with him, obtained only negative results, which left him in great doubt as to the peculiar nature of aricina."

CORTEX CINCHONÆ PURPUREÆ; *Cascarilla boba de hoja morada* (Spurious bark with purple leaves).—This is the bark of *Cinchona pubescens*, *var. β purpurea*, Weddell. Reichel[5] has declared that the bark of this tree, which Poeppig brought to Europe, is identical with the Huamalies bark of commerce. But I am satisfied that this is a mistake. For, in the first place, Martiny[6], who also received a specimen of the bark from Poeppig, has declared that it has not the most remote resemblance to Huamalies bark; and, in the next place, the barks of *C. purpurea*, in Pavon's collection in the British Museum, as well as those brought by Weddell, are entirely different from Huamalies bark, but agree with the description given of them by Ruiz in the *Quinologia*.

The genuine bark of *Cinchona purpurea* has some resemblance to that of *C. cordifolia*. The quills have a rigid fibre, are somewhat warty, and have a smooth, light grey epidermis, somewhat like that of Cusparia bark. They are almost entirely devoid of transverse cracks. The colour of the inner surface of the bark (liber) is cinnamon-brown. The coarser bark of the trunk is dark brown, with patches of the greyish epidermis adherent to it. In 1849, a considerable quantity of this bark, mixed with others, was imported.

The thick coarse bark yielded Mr. J. E. Howard in 100 parts only 0·85 of impure quinine, and 0·60 of cinchonine.

Considered in a medicinal point of view, all the above three sorts of bark are of inferior quality. Poeppig says that the bark of *C. purpurea* may probably be found useful for making cheap decoctions, as it can be sold at a very low price.

IV. CORTEX CINCHONÆ DE HUANUCO.—GREY OR SILVER CINCHONA.

SYNONYMES.—*Quinquina de Lima*, Guibourt; *China Huanuco*, *Graue China*, Bergen; *China Huanuco*, *Yuanuco*, *Guanuco*, *Havane*, Goebel; *Cascarilla provinciana*, Pöppig; *Cinchona cinerea*, Ph. Ed.

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[1] Buchner's *Repertor.* Bd. xxxiii. S. 353, 1830.

[2] *Ibid.* 2te Reihe, Bd. xxv. S. 324, 1842.

[3] *Journ. de Chim. Méd.* t. vi. p. 353, 1830.

[4] *Hist. des Drogues*, 4me édit. t. iii. pp. 160—161.

[5] Hooker's *Companion to the Botanical Magazine*, vol. i. page 252, 1835.

[6] *Encyklop. d. med. Pharm. Naturalien und Rohwaarenkunde*, Bd. i. S. 381, 1843.

The appellations of *grey* or *silver* applied to this bark refer to the colour given to the bark by the thallus of various crustaceous lichens (*Graphideæ*).

HISTORY.—This bark was first known in Spain in 1799. One hundred and eighty chests of it were brought to Santander, in that year, by the frigate La Veloz; and Ruiz was appointed to examine the cargo. He found in the chests a thick bark, till then unknown to the botanists of Peru, mingled with the barks of *C. nitida* and *C. lanceolata*, and with those of the species which Tafalla has designated by the phrase "*similar to Calisaya*."[1] Pöppig[2] says the trade in the barks of Huanuco commenced in 1785; but that in 1815 it almost entirely ceased. The scarcity of yellow bark will be likely again, I should think, to give a fresh impulse to it, as the quality of good Huanuco bark is excellent.

BOTANY.—It is unnecessary to detail the speculations of botanists as to the origin of this bark previous to Pöppig's discovery. This celebrated traveller brought to Europe a bark called *Cascarilla provinciana*, and which was the produce of *Cinchona micrantha*. Reichel, an apothecary at Hohenstein in Saxony, examined and carefully compared it with his own collection of cinchona barks, as well as with that of Von Bergen at Hamburg, and declared it to be identical with the *Huanuco Bark* of commerce.

But under the name of Huanuco or grey bark two distinct barks are found in English commerce,—one of which is the produce of *C. micrantha*, the other probably of *C. nitida*.

COMMERCE.—Grey bark is collected in Cuchero and Huanuco, and is conveyed to Lima, from whence it is exported to Europe. It comes over in chests, and also in serons.

DESCRIPTION.—Grey bark always occurs in the form of quills, which are usually coated. Two sorts are distinguished in English commerce,—one as *fine grey bark*; the other as *coarse* or *inferior grey bark*. These sorts usually come over mixed, but sometimes separately. At a sale of grey bark, in April 1852, Mr. J. E. Howard found the proportions to be as follows:—30 chests of unmixed fine grey, 30 to 40 chests of almost all inferior grey, and 100 chests of fine grey mixed with inferior grey.

1. FINE GREY BARK; *China Huanuco*, Goebel, Pharm. Waarenk. Taf. vii. figs. 1. to 4; *Quinquina rouge de Lima*, Guibourt; *La* [*Cascarilla*] *Peruviana* or *Quina cana legitima*, Laubert, Bull. Pharm. t. ii.—Mr. J. E. Howard regards this bark as the produce of *C. nitida*, R. and P., for it agrees with the bark of this species in Pavon's collection, and its description answers to that given in the Quinologia, and by Laubert, of the bark of C. nitida. The length of the quills is from three to fifteen inches; their diameter from two lines to one and a quarter, or even two inches; their thickness one-third of a line to five lines. At the edge of most of the perfect quills we distinctly observe a sharp oblique cut, made probably to loosen the bark. These oblique cuts are rarely found on other barks. The quills are frequently somewhat spirally rolled. We observe on the epidermis numerous, short, irregular, transverse cracks; but they do not form rings, as in the Loxa or crown bark, and their edges are flat, scarcely separated or everted. The colour of the outer surface is clear or silvery grey, or whitish; in the smaller quills it is a uniform whitish grey, while in the large quills we observe a kind of cretaceous covering, owing to the thallus of some crustaceous lichens. The structure of the inner surface of this kind of bark is, in the small quills, smooth; in the larger ones fibrous: the colour is rather reddish, or rusty brown, than cinnamon brown. The fracture is smooth and resinous; the odour clayish or sweet, and which Bergen says is peculiar to this kind. The taste is astringent, aromatic, and bitter, but not disagreeable; the powder of a deep cinnamon brown. Mr. J. E. Howard, in drawing a parallel between the fine grey (or *nitida*) bark and the inferior grey (or *micrantha*) bark, describes the former bark as having been when fresh "very fleshy," thicker, and not wrinkled longitudinally. The external colour of its derm varies from maroon to rusty, and of its periderm (where not covered with lichens) of a more or less deep brown. The substance of the bark is red. In microscopic structure this sort approximates to Calisaya bark. The decoction of fine grey bark becomes turbid on cooling, and deposits an abundant sediment. The resinous circle, which is very distinctly seen in this bark, "is connected," observes Mr. Howard, "with the constitution of the bark, as indicated by various chemical reagents, which, so far as I have made experiments, concur in showing that it is rich in all the usual constituents of the sap of the Cinchonæ, whilst the predominant feature is the abundance of the tannin." On

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[1] Laubert's *Memoir*, in Lambert's *Illustr. of the Genus Cinchona*, p. 78.

[2] Hooker's *Comp. to the Bot. Mag.* vol. i. p. 244, 1835.

analysis, this bark yielded him 2·113 per cent. of alkaloids; namely, quinine 0·571, quinidine crystallised 0·142, and cinchonine 1·4.

2. INFERIOR OR COARSE GREY BARK; *Quinquina de Lima gris brun*, Guibourt; *Cuscarilla provinciana*, Poeppig.—This is the bark of *C. micrantha* (see *ante*, p. 92). It has been well described by M. Guibourt as follows:—"Bark in the form of long tubes, well quilled, of the size of a writing quill to that of the little finger, very frequently wrinkled longitudinally by drying. The external surface is, moreover, moderately rugous, often almost devoid of transverse fissures, having a general deep-grey tint, but with black or white spots, and bearing here and there the same lichens as those found on Loxa barks. The liber is of a deep-brownish yellow, and as if formed of agglutinated fibres. The taste is bitter, astringent, acidulous, and aromatic: the odour, that of good grey barks."

Mr. J. E. Howard, in comparing this bark with the fine grey sort (*C. nitida*), describes it as being woody or finely fibrous, thinner than the nitida bark, wrinkled longitudinally, glaucous externally (both as regards the derm and epiderm), rusty yellow internally, and approximating to the *scrobiculata* bark in its microscopic structure (see *ante*, p. 92). Its decoction he finds to be pale, and to give a small flocculent deposit on cooling. In reducing this bark to powder, its woody character is very marked. Mr Howard analysed a specimen of this bark, and found that it yielded 1·773 per cent. of alkaloids,—namely, quinine, 0·243; quinidine, 0·28; and cinchonine, 1·25.

CRYPTOGAMIA.—Mosses and Jungermannias are never found on this bark. Foliaceous lichens are much more scarce than on Loxa bark. The following is Fée's list of the Cryptogamia:—

Lichenes.—*Opegrapha Ruiziana; O. Condaminea; O. rugulosa; O. tumidula; Graphis Acharii; G. serpentina; Arthonia confluens; A divergens; A. obtrita; Trypethelium variolosum; Pyrenula marcida; P. myriocarpa; P. mollis; Verrucaria nitens; V. therioplaca; Ascidium Cinchonarum; Lecidea tuberculosa.*

COMPOSITION.—I am unacquainted with any complete analysis of grey barks, though their alkaloid strength has been determined several times. But until the analyses, above quoted, of Mr. J. E. Howard, no one had determined the comparative quantity of alkaloids in the two kinds of grey bark above described. Soubeiran[1] states that one pound of *Grey Lima Cinchona* yields a drachm and a half of sulphate of cinchonia, but he omits all mention of quinine.

The following are the quantities of pure cinchona and quinine in this bark, according to the undermentioned authorities:—

		In one pound of Bark.	
		Cinchonia.	*Quina.*
Von Santen		from 74 to 210 grains	0 grains.
Michaelis	fine sample	50 "	32 "
	second sample	74 "	28 "
Goebel and Kirst		168 "	0 "

Winckler[2] obtained 190 grs. of cinchonia from 16 ounces of strong, middling-sized quills.

According to Puttfarcken[3], Huanuco bark yielded, on an average, only 1·6 per cent. of ashes, the colour of which he describes as being, in different samples, dark green, greenish, green, and grey.

MEDICINAL PROPERTIES.—It must be obvious, from the results of Mr. J. E. Howard's analyses, that the fine grey bark must possess more medicinal activity than the inferior or coarse grey sort, because the total amount of alkaloids (especially of quinine) which it contains is larger.

Good grey bark is, medicinally speaking, a valuable sort of cinchona. Ruiz and Pavon state, that the *nitida* bark (which I believe to be the fine grey sort) is less nauseous and disagreeable to sick persons than other kinds of bark. The *micrantha*, or inferior grey bark, is more nauseous, on account of the greater preponderance of cinchonine which it contains.

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[1] *Traité de Pharm.* i. 583.

[2] Buchner's *Repert.* 2te Reihe, Bd. xxv. S. 324.

[3] *Pharmaceutical Journal*, vol. xi. p. 129, 1851.

V. CINCHONA HUAMALIES.–HUAMALIES BARK.

Synonymes.— *Quinquinas de Huamalies*, Guibourt; *Quinquina Havane* of French commerce; *China Huamalies; Braune China*, Bergen; *China Huamalies, Guamalies*, seu *Abomalies*, Goebel; *Braune China; China Huamalies; China fusca*, Geiger.

History.—It is not known precisely when this kind of bark first came into Europe. Von Bergen thinks that it probably was introduced simultaneously with *silver bark* at the end of the last or commencement of the present century. In 1803 it was frequently carried direct from Lima to Hamburg. This bark is not used as a distinct kind in this country, and hence most druggists are unacquainted with it; but it is bought by some of our merchants for the foreign markets, especially for Germany.

Botany.— According to Reichel,[1] who examined Poeppig's samples, the Huamalies bark of commerce is identical with the *Cascarilla boba;* and, therefore, is the produce of *Cinchona pubescens var. β purpurea*, Weddell. But several reasons lead me to believe that this inference is not correct. 1stly. Huamalies bark is not identical with the bark of this species contained in Pavon's collection in the British Museum, nor with that brought over by Weddell. 2ndly. Dr Julius Martiny,[2] who obtained specimens of Poeppig's bark, declares that *Cascarilla boba*, given to him by Poeppig, does not resemble Huamalies bark; and I can confirm his statement, as he kindly sent me a small sample of the *Cascarilla boba*, which is now in the Museum of the Pharmaceutical Society. 3dly. The bark of *Cinchona purpurea* is very poor in alkaloids, while Huamalies bark is comparatively rich. 4thly. The microscopic structure of the two barks is very different.[3] Mr. J. E. Howard, who has devoted much attention to the subject, is of opinion that Huamalies bark is very near to, if it be not identical with, *Cinchona Chahuarguera*, Pavon (*C. Condaminea var. β Chahuarguera*, De Cand.), which Weddell regards as identical with his *C. Condaminea var. α vera.*

Description and Varieties.—This kind of bark presents very different appearances at different ages, so as almost to defy arrangement. Some of the fine quills might readily be mistaken by inexperienced persons for *Loxa bark.* The large flat pieces, on the other hand, I have known mistaken by an experienced dealer for what he termed "flimsy" red bark.

Some of the finer quills *Huamalies simulating Loxa Bark*) resemble those of Loxa Bark, but are dull grey externally, have fewer transverse cracks, are smoother, or finely striated or wrinkled longitudinally, and when broken, appear nearly white in the interior. This is the *dull grey Huamalies* (*quinquina huamalies gris terne*) of M. Guibourt. Another kind frequently occurs in the Loxa Bark of commerce, and I have heard it termed *rusty crown bark.* It is in larger quills with a whitish or greyish epidermis, which is striated or furrowed longitudinally, but is devoid of transverse cracks, and may be removed by the nail. This is the *thin and reddish Huamalies* (*quinquina huamalies mince et rougeatre*) of M. Guibourt. On some of the pieces we observe rusty-coloured warts, which, when numerous, are disposed in irregular longitudinal lines. A flat or arched variety (*verrucous white Huamalies bark*) has a whitish epidermis, with large red warts, from which the epidermis has been removed. Another kind (*verrucous rusty Huamalies*) is in quills or flat pieces, distinguished by the ochre-red or rusty colour of its outer surface, the presence of warts, arranged for the most part longitudinally, and the almost total absence of transverse cracks.

Cryptogamia.—The following cryptogamic plants are mentioned by Von Bergen as existing on this bark:—

Lichenes.— *Opegrapha enteroleuca; Graphis duplicata; Verrucaria phæa; Porina papillata; Pyrenula discolor; P. mastoidea;* and *P. verrucarioïdes; Lecanora punicea; Parmelia melanoleuca;* and *Usnea florida δ Cinchonæ.*

Composition. The proportion of cinchona alkaloids in this bark has been investigated by Von Santen,[4] Michaelis, Goebel and Kirst,[5] and Winckler.[6] The following are their results:—

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[1] Hooker's *Companion to the Botanical Magazine*, vol. i. p. 252, 1835.

[2] *Encyklopädie d. med. Pharm. Natural. u. Rohwaarenk.* p. 381.

[3] Mr. J. E. Howard, *Pharm. Journal*, vol. xii. p. 61, 1852.

[4] Bergen, *Monograph.* Platt. v.

[5] *Pharm. Waarenkunde*, i. 74.

[6] Buchner's *Repert.* 2te Reihe, Bd. xxv. S. 291 and 326, 1842.

	1 *lb. of Bark.*	*Cinchonia.*	*Quina.*
Von Santen	1. Fine and middling-fine quills, and flat pieces (from Cadiz in 1821)	60	0
	2. Thick warty quills, and flat pieces (from ditto)	75	0
	3. Sorts (from Lima in 1803)	60	0
	4. As No. 3 (another chest), rather heavy	48	0
	5. As No. 3 (a third chest), rather light	95	0
Michaelis...	1st sort	0	12
	2nd sort	48	28
	3rd sort	60	34
Goebel and Kirst (fine and thick quills of commerce)		38	28
Winckler...	1. Thick quills and flat-arched pieces	66	23
	2. Strong, coated, middling thick, fresh-looking quills	8	0
	3. Thin quills which were mixed with Loxa bark	8·5	0·6

It is tolerably obvious from the above analyses, that either different barks have been examined under the name of Huamalies, or that this bark is most unequal in the proportion of alkaloids which it yields. Mr. J. E. Howard[1] says, "I have experimented on a sample of brown warty Huamalies, agreeing in general appearance with Goebel's Pl. x. figs. 1–5, and found the bark rich in alkaloids, and with no peculiarity[2] such as always marks the two varieties of *C. pubescens*."

MEDICINAL PROPERTIES.—These must vary with the proportion of alkaloids which the bark contains. Some specimens are undoubtedly of first-rate medicinal quality.

VI. CORTEX CINCHONÆ DE JAEN.–ASH CINCHONA.

Quinquina de Loxa cendré A, Guibourt; *China Jaen*; *Blasse Ten-China*, Bergen; *China Jaen*, seu *Tenn*, seu *Tena*, Goebel; *Blackish Huanuco*, Batka; *Cascarillo palido*, Ruiz.—It is uncertain at what period it was introduced into commerce. Bergen states he found it in an old collection of drugs made in 1770. It agrees with the bark described in the *Quinologia* as *cascarillo palido* (*C. ovata*, Fl. Peruv.); a specimen of which, in Ruiz's collection of barks, was examined by Bergen,[3] and found to be identical with Ash Cinchona. It is, therefore, the produce of *C. ovata var. a vulgaris* of Weddell. It differs, however, completely both in appearance and composition, from Carabaya bark, which, according to Dr. Weddell, is also obtained from this variety of *C. ovata*.

Mr. J. E. Howard[4] admits seven sorts of bark of *C. ovata*, and refers ash bark to his first sort or the smooth-skinned or pale variety having a light brown substance.

Ash bark is usually imported in chests, but also in serons. It is met with in a quilled form only; the quills being of middling size, or somewhat thick; being from 4 to 16 inches long, from 3½ lines to 1 inch in diameter, and from ½ to 2 lines thick. A very remarkable character of this bark is the crookedness of the quills, which are more or less arched and twisted; from which circumstance we may infer the probability of its being obtained from a tree which grows in a damp situation. On the outer or epidermoid surface we observe a few transverse cracks, and some faint longitudinal cracks; but in these respects there is a manifest difference between this and Loxa bark. The colour of the outer surface varies between ash grey, whitish grey, and pale yellow, with blackish or brownish spots. The inner surface is either even or splintery, and of a cinnamon-brown colour. The fracture is even or splintery; the odour is tan-like; the taste feebly astringent and bitter; the colour of the powder is cinnamon brown.

Ash cinchona must not be confounded with the *ashy crown bark* to be hereafter described (p. 104).

Under the name of "Cusco Bark" I have met with in commerce two barks which are probably the produce of *C. ovata var. a vulgaris* of Weddell, and, therefore, are allied to Ash Cinchona. One of these is a thick coarse quilled bark; the other a thin, flat, leathery sort of bark, in pieces which are four or five inches broad.

Few cryptogamic plants are found on ash cinchona. The following is a list of them, according to Bergen:[1] —*Graphis sculpturata; Porina granulata; Pyrenula verrucarioïdes; Lecanora punicea; Parmelia melanoleuca*, and *Usnea florida β Cinchonæ*.

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[1] *Pharmaceutical Journal*, vol. xii. p. 61, 1852.

[2] The peculiarity here alluded to is the presence of an intensely yellow colouring matter, from which it is difficult to separate the alkaloids.

[3] *Monogr.* 319.

[4] *Pharmaceutical Journal*, vol. xii. p. 126, 1852.

Goebel and Kirst[2] obtained only 12 grains of quinine from a pound of the bark; but Winckler[3] procured 28 grains from 16 ounces. Subsequently Manzini[4] declared that it contained neither quinine nor cinchonine, but a new alkaloid, which he called *cinchovatine* or *cinchovine*. Winckler,[5] however, after a careful comparison, found this supposed new alkaloid to be cusconin or aricine. Guibourt[6] regards it as cinchonine. From a mean-looking specimen Mr. J. E. Howard obtained, crystallised quinidine, 0·61, and crystallised cinchonine 0·86 per cent. Some flat pieces yielded him 1·2 of quinidine and 1·6 of cinchonine.

The medicinal powers of this bark must be inferior, on account of the small proportion of alkaloid which it yields.

VII. CORTEX CINCHONÆ DE LOXA.—LOXA BARK.

SYNONYMES.—*Quinquina de Loxa*, Guibourt; *China Loxa, Kron-China*, Bergen; *Cortex Chinæ fuscæ*, seu *coronæ*, s. *de Loxa*, s. *peruvianus*, Goebel; *Loxa* or *Crown Bark*, Engl. commerce.

HISTORY.—Loxa bark, if not the first, was one of the earliest kinds of Cinchona bark introduced into Europe. It was probably the bark which Horbius,[7] in 1693, denominated *Cascarilla della Oja*, but which Condamine more correctly termed *Corteza* or *Cascara de Loxa*. Of late years, however, various kinds of quilled barks, differing in botanical origin, in appearance, and in chemical constitution, have been imported,—sometimes mixed, sometimes unmixed,—under the name of Loxa or crown bark.

BOTANY.—According to Humboldt[8] (who speaks very positively on this point), the plant figured by M. de la Condamine is the one which Weddell terms *Cinchona Condaminea var. α vera;* though, as I have before stated, M. Guibourt entertains some doubt about the accuracy of this statement. It is probable, therefore, that this is the source of the original or old Loxa bark.

C. Condaminea var. β Candollii furnishes an inferior Loxa bark. From M. Guibourt's observation on the barks in M. Delessert's collection, it would appear that *C. Condaminea var. β Candollii* yields yellow Loxa bark (*amarilla de Loja*).

The bark of *C. Condaminea var. γ lucumæfolia* has also been sold in London as crown bark: I shall distinguish it as *white crown bark*.

From Humboldt's observations respecting the bark of *C. scrobiculata var. α genuina* (p. 75), it would appear that this forms part of the Loxa bark of commerce.

Mr. J. E. Howard[9] thinks that *C. glandulifera* is the source of the H. O. crown bark.

C. cordifolia var. β rotundifolia may perhaps yield the *Ashy crown bark* of commerce.

COMMERCE.—Crown bark is imported from Loxa and Lima: in the former case it is shipped at Payta, in the latter at Callao. It is imported in serons and chests. After its arrival it is frequently picked and sorted. The slender, finest, thinnest, and longest quills, with a short transverse fracture, form the *finest* or *picked crown bark* (*cortex cinchonæ coronæ electus*).[10] A somewhat larger quill, with a silvery appearance of the epidermis, derived from the adherent crustaceous lichens, constitutes the *silvery crown bark*. A similar kind, but in which the external coat has a speckled appearance from the whitish lichens, with the intermediate dark-brown colour of the epidermis, constitutes the *leopard crown bark*.

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[1] *Monogr.* S. 318.

[2] *Pharmaceutische Waarenkunde*, Bd. i. S. 67, 1827-29.

[3] Buchner's *Repert.* Bd. xxv. S. 323, 2te Reihe, 1842; also, *Chemical Gazette*, vol. i. p. 99, 1842.

[4] *Journ. de Pharm. et de Chim.* t. ii. p. 95, 1842; also, *Chemical Gazette*, vol. i. p. 45, 1842.

[5] Buchner's *Repert.* Bd. xxx. S. 249, 2te Reihe, 1843; also, *Chemical Gazette*, vol. ii. p. 189, 1844.

[6] *Hist. Nat. des Drog.* 4ème édit. t. iii. p. 161, 1850.

[7] Bergen, *Monogr.* S. 313.

[8] *Plant. Æquin.* vol. i. p. 33, tab. 10.

[9] *Pharmaceutical Journal*, vol. xii. p. 128.

[10] Condamine observes: "They told me at Loxa, that *anciently* they preferred the *largest barks* (*les plus grosses écorces*), which were put aside with care as the most precious; *now*, the smallest are preferred. One may suppose that the dealers find their advantage in this, because the fine quills go in a smaller compass. But a director of the English South Sea Company at Panama, by which place all the bark which goes to Europe necessarily passes, assured me that the preference now shown for the smallest quills is founded on analyses of English chemists of both barks, and it is probable that the difficulty of drying perfectly the large

VARIETIES AND DESCRIPTION.—The chief and most important barks to which the name of Crown or Loxa bark has been applied, are the following:—

1. ORIGINAL OR OLD LOXA BARK.—This is the *original* or *true crown bark*, and is probably the produce of *C. Condaminea var. a vera*, Weddell. It is said to have received its name from the following circumstance:—

In October 1804, a Spanish galley, returning from Peru, was taken by our countrymen off Cadiz. Among the treasures found therein were many parcels of cinchona bark, two sorts of which were distinguished from the others by their external appearance and mode of packing. Two of these chests were marked "*Para la real familia*," i.e. "*For the royal family*," and were lined with sheet iron: they contained fine quills, of thirteen inches long, tied up by means of *bass* into bundles of about three inches in diameter. Von Bergen states he received from England, in 1824, similar bundles, under the name of *second crown*. The other sort was marked "*Para la real corte*," i. e. "*For the royal court*."[1] Occasionally, but less frequently than formerly, bundles thus packed occur in the serons of crown bark of commerce. Hayne[2] pointed out some differences between the Loxa bark of commerce and a bark found in Humboldt's collection, marked *Quina de Loxa*, and which had been collected from *C. Condaminea*: the peculiar characteristics of the latter are the warty prominences, the transverse cracks, which do not form rings, the browner tint of the outer surface, and a more astringent taste. In a chest of 120 lbs. of commercial Loxa bark, Goebel found only three ounces of bark corresponding to the description here given of the true Loxa bark.

I have received from Mr. Berthold Seemann a specimen of *quina fina* which he himself gathered from *C. Condaminea var. a vera*, Weddell, at Loxa. It is in slender quills, with numerous transverse cracks, and has a silvery appearance externally, from the presence of adherent crustaceous lichens. It is the kind which I have designated *silvery crown bark*.

Mr. J. E. Howard analysed some "fine old Loxa" quills which were sold in 1850. They had traditionally remained in the London Docks twenty-five or thirty years, and the packages were decaying with age. Some of them were tied up in bundles; some resembled *quinquina gris fibreux royal d'Espagne* of M. Guibourt; others were thick heavy quills. The first sort in bundles yielded him, in 100 parts of bark, quinine 0·714, quinidine 0·514, and cinchonine 0·04. The larger and stouter quills were richer in alkaloids, especially in cinchonine. "I conclude, therefore," says Mr. Howard,[3] "that the old original 'crown bark,' the fine Loxa of Uritusinga, was one which well merited its character, on account of the quantity of alkaloids contained, which (taking the whole together, for the bark is rich in cinchonine, and Calisaya is not) equals the sum total of alkaloids in some specimens of Calisaya bark."

2. WHITE CROWN BARK.—By this designation I propose to distinguish the *lucuma-leaved cinchona bark*. In 1848 a chest of it was sold in London as "crown bark," yet it differs in appearance considerably from the ordinary crown bark of commerce. The small or fine quills are scarcely distinguishable from some quills of silvery crown bark given me by Mr. Seemann, who gathered them from *C. Condaminea*. The large quills, however, present an entirely different appearance from every other sort of cinchona bark with which I am acquainted. The coated large quills are devoid of transverse cracks, but are rugged externally from the longitudinal rents or fissures produced by

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quills, and their consequently becoming damaged, has contributed to bring them into discredit. The common prejudice is, that, in order to lose none of their virtue, the tree should be stripped in the waning of the moon, and on the east side of the tree; and they did not forget to make affirmation before a notary of these circumstances in 1735, as well as of its having been gathered on the mountain of Cayanuma, when the last Viceroy of Peru made a provision of bark to carry to Spain on his return. The interest of the collection, which forbids them to remain inactive three-quarters of the year, has caused most of those who gather the bark to give up their prejudice, such as my host at Cayanuma, who assured me that all the seasons of the year were equally proper, so long as the weather was dry."

[1] Bergen, *Monograph.* S. 310.

[2] Goebel und Kunze, *Pharm. Waarenk.* i. 36.

[3] *Pharmaceutical Journal*, vol. xi. p. 494.

the expansion of the growing stem; and the subjacent suberous coat which is thus exposed is remarkable for its white satiny or silvery lustre. This bark is the produce of *C. Condaminea var.* γ *lucumæfolia*, Weddell; and its produce in alkaloids resembles that of other varieties of C. Condaminea.

3. H. O. CROWN[1] BARK. — This is the crown bark usually found in commerce. It is imported from Payta, and occurs in the form of single and double, fine and middling, coated quills, which vary in length from 6 to 15 inches; in diameter, from 2 lines to an inch; in thickness, from one-third of a line to 2 lines.

α. Some of the quills are remarkably devoid of lichens; are composed of a thin bark, which externally has a brown shrivelled appearance, being covered with numerous longitudinal wrinkles, and having very few transverse cracks. The transverse fracture is short. The internal surface is of a cinnamon colour, but the fractured surface is pale yellow.

β. Other quills approximate in appearance to those of grey bark. They are larger and coarser than the preceding, are more or less greyish externally from adherent lichens, and are furnished with numerous transverse cracks, some of which extend completely around the quill in the form of a ring.

γ. Some of the quills greatly resemble those of ashy crown bark, consisting of twisted quills, which have the same patchy (black and white) appearance, from the adherent lichens.

The origin of "H. O. crown" bark is not accurately known. Mr. Howard and myself found no bark exactly resembling it in Pavon's collection. As Humboldt states that the bark of *C. scrobiculata* is sold as "quina fina," it might be presumed that this is in part the source of the "H. O. crown" bark, which appears to have replaced, in commerce, the original old Loxa bark (*C. Condaminea*). But Mr. J. E. Howard has assigned several reasons for believing that ashy crown bark is identical with the *cascarilla negrilla* of Poeppig, and, therefore, is produced by *Cinchona glandulifera*.

Mr. J. E. Howard has analysed two samples of this bark, and the following are his results: —

1000 parts.	*Quinidine* (finely crystallised from ether).	*Cinchonine.*
Fine sample (in the market in 1850)	5·7	0·6
A beautiful sample (in the market in 1851)...	10·5	0·8

The sample last mentioned "was in larger quills, and the large quills must always be expected to contain more alkaloid than those which consist almost entirely of outer coat. So that we have not only the substitution of barks poorer in alkaloids for the old Loxa richer in alkaloids, but we have quinidine substituted for quinine, if this be of any importance."

4. ASHY CROWN BARK of English commerce; *China Pseudo-Loxa* or *Dunkele-Ten-China*, Bergen; *Dunkle Jaen China*, Goebel; *Quinquina de Loxa cendré B*, Guibourt. — This bark must not be confounded with the *ash* or *pale Jaen bark*, from which it is quite distinct.[2] It is imported from Lima in serons and bags. It occurs in quills of about the size of the fingers, and which abound in foliaceous and filiform lichens (*Parmelia melanoleuca*, *Sticta aurata*, *Usnea*, &c.) The powdery and crustaceous lichens give this bark a very speckled or patchy appearance; the white, grey, and black patches being predominant. Some of the black patches are soot-like. Many of the quills are covered with rusty warts or fungoid tubercles which perhaps have been produced by the puncture of an insect. Quills covered with these warts (which are sometimes as large as a coffee seed) have a scabious appearance. The epidermis is marked by longitudinal wrinkles and transverse cracks, by which, as well as by its blacker colour, it is readily distinguished from ash bark. The internal surface is of an orange or cinnamon colour. The taste of this bark is bitter. This bark agrees with the specimen in Pavon's collection marked "*Cascarilla con hojas redondas de Quiebro de Loxa*" (*i. e.* "the bark of the round-leaved cinchona of the Quiebro of Loxa"). From this it would appear to be the produce of *C. cordifolia var.* β *rotundifolia* of

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[1] "The 'H. O.' and a crown were brands adopted, in the time of the Spanish dominion, for two different sorts of bark, which are both included now under the general title, 'crown bark.'" — J. E. Howard, *Pharm. Journ.* vol. xi. p. 494.)

[2] M. Guibourt (*Hist. Nat. des Drog. simpl.* 4me éd. tom. iii. p. 152, 1852) has included both *ash* or *pale Jaen bark* and *ashy crown bark* under one name; viz. that of *quinquina de Loxa cendré* (ashy Loxa bark). The former constitutes his variety "A," the latter his variety "B."

Weddell. Bergen says that it agrees with a bark contained in Ruiz's collection, which was said to be obtained from *C. lancifolia* of Mutis. But it differs from the lancifolia barks with which I am acquainted.

This bark has been analysed by Mr. J. E. Howard; and the following are his results: —

1000 *Parts of*	*Quinidine and Quinine.*	*Cinchonine.*		*Total Alkaloids.*
Ashy crown, from Lima	5·00	9·14	=	14·14
Ashy crown mixed with corky crown, from Lima	4·00 (quinidine chiefly)	2·85	=	6·85
Ashy crown (corresponding with the Dunkele-Ten-China), from Lima	4·57	3·00	=	7·57

4. **Wiry Loxa Bark**; *Twiggy Loxa Bark.* — Imported from Payta in serons. In April 1852 I saw three serons of this bark put up for sale. It occurs in very slender, wirelike quills, which are tolerably smooth externally, with scarcely any transverse cracks. The epiderm is brown, in some places slightly grey, without any adherent foliaceous or filiform lichens. Many of the quills are lined by a thin shaving of pale yellow wood with the bark from the branch. Its taste is very astringent, and but slightly bitter. To the fracture it is short and resinous. It yields scarcely any alkaloid, and its quality, therefore, is very inferior. Nothing certain is known of its origin.[1]

Cryptogamia. — The following is Fée's list of the Cryptogamia found on Loxa bark: —

Lichenes. — *Opegrapha globosa*; *O. Condaminea*; *Graphis fulgurata*; *Arthonia sinensigraphia*; *A. marginata*; *Glyphis favulosa* (rare); *Chiodecton effusum*; *Pyrenula verrucarioïdes*; *Ascidium Cinchonarum*; *Lepra flava*; *Lecidea peruviana*; *Lecanora russula*; *L. subfusca*; *id. var.* β *pulverulenta*; *Parmelia crenulata*; *P. glandulifera*; *Sticta aurata*; *Collema azureum*; and *C. diaphanum*.

Composition.— Loxa bark (quinquina gris) was analysed by Pelletier and Caventou,[2] and by Bucholz.[3]

Pelletier and Caventou's Analysis.

Kinate of cinchonia.
Kinate of lime.
Green fatty matter.
Red cinchonic.
Soluble red colouring matter (tannin).
Yellow colouring matter.
Gum.
Starch.
Lignin.

Grey cinchona.

Bucholz's Analysis.

Cinchonia	0·36
Kinic acid	1·17
Kinate of lime	1·30
Hard resin (red cinchonic)	9·97
Bitter soft resin	1·56
Fatty matter, with chlorophylle	0·78
Tannin, with some chloride of calcium (?)	5·80
Gum	4·43
Starch	a little
Lignin	74·43
Commercial Loxa bark	99·80

Soubeiran[4] states, that one lb. of Loxa bark yields from one and a half to two drachms of sulphate of cinchonia. It is somewhat remarkable that Von Santen[5] obtained quina, and but little cinchonia, from Loxa bark, as the following table shows: —

1 *lb. of Loxa Bark.*	*Sulphate of Quina.* grains.	*Pure Cinchonia.* grains.
Fine selected quills	5	—
Moderately thick quills and pieces	12	$4\frac{2}{3}$
Fine and middling quills	2	$2\frac{2}{3}$
Moderately thick pieces	$21\frac{1}{3}$	—
Selected thick, heavy pieces, with grater-like bark	$53\frac{1}{4}$	—

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[1] On account of its remarkably slender quills, this bark might be presumed to be the *cascarilla delgada* or *delgadilla* (slender bark), or *cascarilla fina delgada* (fine slender bark), which Ruiz and Pavon state is obtained from *Cinchona hirsuta*: but it is devoid of the small transversal cracks which, it is said, render the surface of the *delgada* bark rough. In its smoothness and colour, wiry Loxa bark somewhat resembles young *negrilla* bark.

[2] *Journ. de Pharm.* vii. 70.

[3] Gmelin, *Handb. d. Chem.* ii. 1283.

[4] *Traité de Pharm.* i. 603.

[5] Bergen, *Monogr.* Tab. zur 5ten Platte.

Winckler[1] procured from 16 ounces of selected Loxa bark 56 grains of alkaloids; namely, 33 grains of pure quinine and 23 grains of cinchonine.

Mr. Howard's analyses before quoted have shown that the different barks, known in commerce as Loxa or Crown bark, vary considerably in the proportion of alkaloids which they contain.

Medicinal Properties.—Fine old Loxa bark is probably almost equal in therapeutical powers to Calisaya bark; and the same may be said of the lucuma-leaved cinchona bark. The ordinary Loxa barks of commerce are, however, very inferior in medicinal activity.

VIII. CORTEX CINCHONÆ RUBRÆ.—RED CINCHONA.

Cinchona rubra, *L. E. D.*

Synonymes.—*Quinquina rouge verruqueux*, and *non-verruqueux*, Guibourt; *China rubra Rothe China*, Bergen; *China rubra*, *Cortex Chinæ ruber*, Goebel; *Cascarilla roxa verdadera*, Laub. [genuine red cinchona].

History.—The earliest travellers in South America, who have noticed cinchona bark, distinguish the different sorts by their colour; and both Mr. Arrot and Mons. Condamine speak of a *red bark* (*cascarilla colorada*), and describe it as being of superior quality. Dr. Saunders[2] states, that in the year 1702 a parcel of bark (which he says was the red kind) was taken on board a Spanish vessel, and a portion of it fell into the hands of a celebrated London apothecary, Mr. D. Pearson. In 1779, another Spanish ship, bound from Lima to Cadiz, was taken by an English frigate, and carried into Lisbon. Her cargo consisted principally of red bark, and was, for the most part, sent to Ostend, where it was purchased at a very low price by some London druggists, who, after some difficulty, contrived to get it introduced into practice.

Botany.—Although the term *red bark* is now usually employed to designate a particular sort of bark, yet a red colour is in reality not characteristic of any one bark in particular, but is common to many; and, moreover, it appears to be a non-essential quality, and to depend on accidental circumstances,—such as locality, soil, age of the tree, mode of drying the bark, &c. Thus *C. lancifolia* yields both a red as well as an orange bark; and some of the pieces of the red bark of commerce are scarcely distinguishable in colour from those of yellow bark. Weddell says he has met with the red tint in the barks of *C. ovata*, *C. scrobiculata*, *C. pubescens*, and even in *C. Calisaya*; and at one time he fancied that the first-mentioned of these species (C. ovata) was the source of the genuine red bark of commerce.

The *Cascarilla magnifolia var. α vulgaris* of Weddell (*Cinchona oblongifolia* of Mutis) yields a purple-red bark called *Quina roxa*, or *Quina Azahar o roja de Santa Fé;* and which was supposed to be the red bark of commerce. But Bergen has examined the bark bearing this name in the collection of Ruiz, and finds that it is not commercial red bark, but the *Quinquina nova* of the French pharmacologists. Moreover, Schrader (who received a piece of the bark from Humboldt) declared it to be a new kind; and Guibourt[3] states that the red bark of Mutis, which was deposited by Humboldt in the Museum of Natural History of Paris, is not commercial red bark, but *Quinquina nova*. To these statements may be added the testimony of Ruiz and Pavon, and of Humboldt; the two first of which writers state that the *Quina roxa* is obtained from *Cinchona oblongifolia*,[4] but they do not know the origin of *Quina colorada* (the red bark of commerce); and Schrader states that Humboldt declared he did not know the tree that yielded red bark.[5]

[Since these sheets were prepared for press, a paper has appeared by Mr. John Eliot Howard, in which he shows that the red cinchona bark is almost certainly the product of a variety of Cinchona ovata (var. γ erythroderma).[6]—Ed.]

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[1] Buchner's *Repertorium*, 2te Reihe, Bd. i. S. 213, 1835; and Bd. xxv. S. 325, 1842.

[2] *Observations on the Superior Efficacy of the Red Peruvian Bark*, p. vi. 1782.

[3] *Hist. des Drog.* 4me édit. t. iii. p. 123, 1850.

[4] The *Cinchona oblongifolia*, Mutis (*C. magnifolia*, Fl. Peruv.) is the *Cascarilla magnifolia, var. α vulgaris*, Weddell. It is, therefore, a false cinchona, and its bark might be distinguished as *false red bark.* It is the *Savanilla bark* of Batka (*Pharmaceutical Journal*, vol. xi. p. 321, 1852).

[5] Bergen, *Monogr.* S. 268.

[6] For the arguments adduced, and the figure of the leaves, &c., see *Pharm. Journ.*, Oct. 1st, 1856, vol. xvi. No. 4.

CE. — Imported from Guayaquil and Lima in chests. Good samples are
am informed by an experienced dealer that this bark was formerly imported
rger-sized pieces than they are now met with.

TION. — Red bark occurs in quills and flat pieces. The quills vary in dia-
n two lines to an inch and a quarter; in thickness, from one-third to two
length, from two to twelve or more inches. The so-called flat pieces are
slightly curled: their breadth is from one to five inches; their thickness
third to three-quarters of an inch; their length from two inches to two feet.
rk is generally coated, and consists of liber, the cellular and suberous coats,
ly more or less of the epidermis: its outer surface is usually rough, wrinkled,
and frequently warty. The colour of the epidermis varies: in the thinner
greyish-brown, or faint red brown; in thick quills and flat pieces it varies
ddish-brown to a chestnut-brown, frequently with a purplish tinge. As a
ule, it may be said that the larger and coarser the quills and pieces, the
e colour. Cryptogamic plants are not so frequent on this as on some other
bark. The cellular coat is frequently thick and spongy, especially in large
s; much more so than in yellow bark. It forms the round tubercles or warts.
r surface of the bark is, in fine quills, finely fibrous; in large quills and flat
arsely fibrous, or even splintery. Its colour increases with the thickness and
e pieces: thus, in fine quills it is light rusty brown; in thick quills and flat
s a deep reddish or purplish brown. Some of the specimens of red bark which I
ived from Von Bergen, as well as of those which I have found in English com-
proach yellow bark in their colour. The transverse fracture of fine quills is
of middling quills, somewhat fibrous; of thick quills and flat pieces, fibrous
tery. The taste is strongly bitter, somewhat aromatic, but not so intense and
t as that of yellow bark; the odour is feeble and tan-like; the colour of the
faint reddish brown.

TIES. — The obvious and common distinction is into *quilled red bark* and *flat red*
he warty pieces constitute the *quinquina verruqueux* of Guibourt; the pieces
warts are the *quinquina non-verruqueux* of the same pharmacologist. In the
of commerce we frequently find pieces with a white micaceous suberous coat:
ich are probably the produce of a distinct species of Cinchona, constitute the
rouge de Carthagène of Guibourt.[1]

onsumption of red cinchona being very small, but little attention has been paid
no distinctions are made of it, except into the *quilled* and the *flat*; the latter
bdivided into *coated* and *uncoated*.

SITION. — According to Pelletier and Caventou,[2] red bark contains *super-*
cinchonia, *superkinate of quina*, *kinate of lime*, *red cinchonic*, *soluble red colour-*
r (tannin), *fatty matter*, *yellow colouring matter*, *lignin*, and *starch*. Soubeiran[3]
at one lb. of deep-red cinchona yields two drachms of sulphate of quina and
hm of sulphate of cinchonia; while one lb. of pale red cinchona yields a drachm
lf of the sulphate of quina and one drachm of sulphate of cinchonia.

llowing are the quantities of cinchona alkaloids obtained from this bark by
ten,[4] by Michaelis, by Goebel and Kunze,[5] and by Winckler.[6]

Nat. des Drog. 4ème édit. t. iii. p. 126. — In the 3d edit. of Guibourt's work, this bark
quinquina rouge à épiderme blanc et micacé, and in the 2d edit. *quinquina Carthagène*
he author thinks that it differs from *spongy Colombia bark* (*quinquina de Colombie*
) only in colour. He says that "the evident resemblance which exists between the
ed non-verrucous bark and the *red Lima bark*, between the *red woody Carthagena bark*
y Colombia bark, and lastly, between *red and spongy Carthagena bark* and *spongy Co-*
rk, has for some time past led me to think, what I have not hitherto stated verbally,
red cinchonas do not constitute distinct species, but are only particular states of
cies, caused probably by the great age of the trees."

de Pharm. vii. 92.

té de Pharm. i. 603.

en, *Monogr.* Plate 1.

Waarenk. i. 72.

ner's *Repert.* 2te Reihe, Bd. xxv. S. 325, 1842.

1 *lb. of Bark.*		Cin-chonia.	Sulphate Quina.	Qui
		grs.	grs.	grs
Von Santen	1. Fine quills of fresh appearance (from Cadiz in 1803)	70	77	
	2. Large, broad, flat pieces, of flesh brownish-red appearance (same chest)	90	15	
	3. Middling quills, from their pale appearance probably 20 years older than the previous (from Cadiz in 1819)	97	31	
	4. Broad flat pieces, not so thick as No. 2 (same chest as No. 3)	80	30	
	5. Middling quills, heavy, old (from London to Hamburgh in 1815 : not met with now)	150	11	
	6. Thicker heavier quills (same chest)	184	9	
	7. Thick flat pieces, quills, and fragments (above 80 years in Hamburgh : a pale kind)	20	7	
Michaelis		32	—	64
Goebel and Kunze (flat pieces)		65	—	40
Winckler...	1. Dark heavy flat-coated pieces	180	—	8
	2. Pale thin flat pieces	80	—	6

CRYPTOGAMIA. — The following are the cryptogamic plants on red cinchona, acco ing to Fée :[1] —

Lichenes.—*Opegrapha Bonplandi ; O. farinacea ; Graphis Acharii ; G. exilis ; frumentaria ; Pyrenula verrucaroïdes ; Verrucaria sinapisperma ; Thelotrema urceola T. terebratum : T. myriocarpum ;* and *Lecidea conspersa.*

MEDICINAL PROPERTIES. — Red bark, when of good quality, approximates in therapeutical powers to the best Calisaya bark.

IX. CORTEX CINCHONÆ CONDAMINEÆ PITAYENSIS.—PITAYA CONDAMINEA BARK.

Quinquina Pitaya, ou *de la Colombie*, ou *de Antioquia ;* Guibourt, Hist. des Dr t. iii. p. 140, 4me éd. 1850 ; *Quinquina Pitaya*, Peretti, Journ. de Pharm. t. xxi. p. 5 1835 ? ; Muratori, Pharm. Central-Blatt für 1839, p. 662 ?.[2] According to the obs vations of Mr. J. E. Howard and myself, made on M. Guibourt's specimens, the *qu quina brun de Carthagène* of the last-mentioned author is identical with the *Pitaya C daminea bark.*

The bark of *Cinchona Condaminea var. ε Pitayensis*, Weddell.[3] Imported into Engl from Buenaventura in New Granada.

Bark consisting of single or double quills, or half-rolled pieces. I have specim which are more than a foot in length. Some samples, however, which I have recei consist of pieces not exceeding two or three inches in length, sometimes entirely, others only partially, coated ; the partially-coated pieces consist of the suberous cellular coats and liber. Epidermis, when present, dark brown, frequently coated crustaceous lichens, marked by numerous closely set transverse cracks, with promin or slightly everted borders, which give the bark a grater-like feel ; and here and th presenting round or oval warts or fungoid rusty tubercles, varying in size from a gr

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[1] *Cours d'Hist. Nat.* ii. 265.

[2] The designation "Pitaya or Pitoya bark" having been loosely applied to several diffe sorts of bark, it is somewhat difficult to determine with certainty the synonymes of the b described in the text. From M. Guibourt I received samples of it in 1830. Mr. J. E. How informs me that the bark which M. Guibourt recently showed him as *ligneous Pitaya bark*, as the bark which Peretti analysed, is a *lancifolia* bark. It is, therefore, probable that Pere *pitayne* is identical with *quinidine.*— The Pitaya-Condaminea bark above described must be confounded with the *bicoloured bark* (*quinquina bicolore* of M. Guibourt), which has also b called "Pitaya bark."

[3] *Histoire Naturelle des Quinquinas*, 1849.—More recently (*Ann. des Sciences Nature* May 1849) Weddell has made this plant a distinct species under the name of *C. Pitayen* but, to avoid the confusion of names, I have preferred the designation of "Pitaya-Condami bark" to that of "Pitaya bark."

t to a seed of coffee, and usually marked like the latter with a longitudinal,
es also, with a transverse fissure. The suberous coat in some pieces much de-
spongy or fungous, fawn-yellow, sometimes brown in the interior and fawn-
xternally and internally. Resinous tissue, on the inside of the suberous coat
ich it is definitely separated, shining, of a dark reddish colour. Liber gradu-
ing into the resinous coat, hard, dense, dark reddish-brown; cortical fibres
short.

a-Condaminea is a firm heavy bark, having a very bitter, rather disagreeable
which is slowly developed.

bark is rich in alkaloids, and serves for the manufacture of disulphate of qui-
It contains cinchonine, quinidine, and quinine. From one kilogramme (or 1000
s) of this bark, M. Guibourt obtained 23 grammes of crystallised cinchonine,
grammes 52 centigrammes of sulphate of quinine; showing that it is one of the
cinchona barks. Muratori has published an analysis of "Pitaya bark," but I
btful whether his bark is identical with that which I have described. From 12
of bark he obtained 17 grains of quinine, 80 grains of cinchonine, and 18 grains
uliar alkaloid [quinidine?].

e observations of Mr. Howard and myself, as to the identity of Guibourt's *brown*
gena bark and the *Pitaya Condaminea bark*, be correct, it follows that this is
k which Pelletier and Caventou[1] analysed under the name of *quinquina Car-*
, and which they found to contain both quinine and cinchonine, and to be
y analogous in composition to red bark. The resinoid matter in it was very
nt.

ical analysis proves that, in a medicinal point of view, the Pitaya-Condaminea
one of the most valuable cinchona barks. In New Granada it is in great
;[2] and experiments made with it in Italy[3] show that its reputation is well de-

X. CORTEX CINCHONÆ LANCIFOLIÆ.—LANCE-LEAVED CINCHONA BARK.

NYMES.—*Quina naranjada* vel *Q. primitiva*, Mutis; *Quinquina orangé*, Humb.;
lla naranjada de Santa Fé, Laubert; *Quinquina Carthagène spongieux*, Guibourt,
Q. orangé de Mutis, Guibourt, 1850; *Quinquina rouge de Carthagène*, Guibourt;
lava fibrosa, Goebel,[4] 1827-29; *New Spurious Yellow Bark*, Pereira, 1830;
a aurantiacea de Santa Fé, Pereira, 1842; *Orange-coloured Cinchona Bark;*
a [*Caqueta?*] *Bark*, English commerce; *Bogota Bark*, *Chinarinde von Bogota*
Bogotensis), Mettenheimer,[5] 1852.

nglish commerce the name of *Carthagena bark* is applied to this, as well as to
k of *C. cordifolia*, even when it is shipped from a port on the Pacific. By way
action the former may be called *spongy* or *fibrous Carthagena bark*, and the latter
rthagena bark.

ORY.—This bark was distinctly noticed in 1793 by Mutis,[6] who claims to be the
rer of the tree yielding it: but the claim is contested by Lopez Ruiz, who as-
at he discovered it at Santa Fé in 1772.[7] By Mutis and his followers the fe-

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n de Pharm. t. vii. p. 101, 1821.

he *Times* newspaper for September 29th, 1824, it is stated that a mule's load of
bark" had been sent to the British Consul at Bogota, for transmission to England;
mbians considering it to be equal, if not superior, to Peruvian bark. But as no de-
of the bark is given, it is impossible to determine what sort of bark is here referred
re recently, the government of Colombia sent to Rome, as a present to Pope Gregory
me "Pitaya bark," which fetched a high price, and was said to be preferred in Co-
o other species of cinchona barks for the treatment of fevers (*Journ. de Pharm.* t. xxi.
835). A specimen of this bark was sent to Paris, and was declared by Guibourt
de l'Académie Royale de Médecine, t. iv. p. 245, 1839-40) to be identical with his Co-
r Antioquia bark. The medicinal efficacy of Muratori's Pitaya bark has been proved
allenzesca, of Venice.

enzesca, quoted by Muratori.

n. Waarenkunde, p. 59.

buch für prakt. Pharmacie, Bd. xxiv. p. 229, April 1852.

l Periodico de Santa Fé, Num. iii. Oct. 11, 1793, p. 465; also, *Mercurio Peruano de*
Literatura, y Noticias Publicas que da a luz la Sociedad Academica de Amantes de
no xii. fol. 211, Lima, 1795.

ert's Illustr. pp. 28 and 83; also, Lopez Ruiz, *Defensa y Demostracion del verdadero*
r de las Quina del Reyno de Santa Fé, en Madrid, 1802.

brifuge qualities of this bark have been greatly lauded;—by others, much depreciated "The effect of mercantile cunning," says M. Humboldt, "went so far, that, at th royal command, a quantity of *the best orange-coloured cinchona bark*, from New Granada which M. Mutis had caused to be peeled at the expense of the king, was burned, as a decidedly inefficacious remedy, at a time when all the Spanish field-hospitals were in the greatest want of this valuable product of South America."[1] In 1830 I met with it in English commerce under the name of *New Spurious Yellow Bark*. It was unsaleable, and lying in a warehouse at the London Docks. I sent a specimen of it to M. Guibourt, who identified it as the bark which he had described as *spongy Carthagena bark* (Quinquina Carthagène spongieux), and which M. Humboldt had deposited in the Muséum d'Histoire Naturelle of Paris, as Mutis's *Quina naranjada*.

Within the last few years it has been again introduced into commerce by M. Lopez, of Bogota, as a source of quinine, under the name of *Coquetta*[2] (or Caqueta?) *bark*: and the high price of Calisaya bark has induced manufacturers to employ Coquetta bark in the manufacture of disulphate of quinine; and in this way it has obtained, as is observed by Mr. J. E. Howard,[3] "a certain reputation in commerce, and proves neither so good as was boasted on the one hand, nor so bad as was represented on the other, in the celebrated controversy between the botanists of Peru and of New Granada."

BOTANY. — This bark is the produce of *C. lancifolia* of Mutis (the *C. Condaminea var. δ lancifolia* of Weddell).

COMMERCE. — The lancifolia bark is chiefly brought to England from New Granada, usually by way of Bogota and Carthagena on the Atlantic side. Occasionally a similar species of bark is brought from Lima in Peru.

DESCRIPTION. — The lancifolia barks of commerce vary considerably in appearance. Those obtained from the younger stems and branches would scarcely be identified, by a superficial observer, with those procured from older stems. But their leading and common characteristic is an extremely fibrous quality.[4] They may be arranged in two divisions:

1. Barks of young stems and of branches, mostly quilled, coated usually with a brownish or yellowish epidermis, often covered with whitish crustaceous lichens, which give it a greyish or silvery appearance, as well as with foliaceous and fibrous lichens. The quills vary in size from that of the little finger to an inch and a half in diameter. Some of them are smoothish, others rather rough from numerous short slight cracks (longitudinal and transverse), with slightly everted edges. They are extremely fibrous, and moderately bitter. Altogether they would pass with many observers for *grey barks*.[5] It is the very fibrous character of this bark that must have given origin to the name of *towy bark* (*C. stupea; Quina estoposa*). Mr. J. E. Howard considers this bark to be identical with Guibourt's *King of Spain's fibrous red Loxa cinchona* (quinquina de Loxa rouge fibreux du Roi d'Espagne), and with Lambert's *lizard-coloured* (lagartijada) bark, which is described as being entirely ligneous.

According to Mr. J. E. Howard, the bark which was analysed by Peretti,[6] under the name of *Pitaya bark*, was a coated lancifolia bark in coarse quills. His opinion is founded on the examination of specimens shown to him by M. Guibourt,[7] who has described it as being identical with Pitaya-Condaminea bark.

Uncoated lancifolia quills are sometimes met with. In form and size they resemble coarse cassia lignea.

2. Barks of the trunk or of old stems composed of the liber, the cellular coat, and

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[1] Humboldt, in Lambert's *Illustr.* p. 33.

[2] The commercial name for it is *Coquetta* or *Coqueta*. It is probable, I think, that the word should be *Caqueta*, one of the names of the Yapura or Japura river which rises in the Andes of New Granada.

[3] *Pharmaceutical Journal*, vol. xi. p. 562, 1852.

[4] The bark contained in Pavon's collection in the British Museum, and marked "*Quina estoposa de Loxa*" (Towy [or Fibrous] Cinchona of Loxa), is probably a lancifolia bark (see Mr. J. E. Howard's paper in the *Pharmaceutical Journal*, vol. xi. p. 558).

[5] In April 1852, some serons of a quilled lancifolia bark were exposed for sale at the London Docks, along with serons of grey barks, from which they did not appear to be distinguished.

[6] *Journ. de Pharmacie*, t. xxi. p. 513, 1835.

[7] *Bulletin de l'Académie Royale de Médecine*, t. iv. p. 245, 1839; and *Hist. Nat. des Drog.* 4me édit. t. iii. p. 141, 1850.

itish or yellowish-white thin micaceous suberous coat. The larger pieces indrical, or more or less channelled, 4 or 5 inches in diameter, ¾ of an inch ary in length from 1 or 2 to 21 inches. The liber is extremely fibrous, very er, in some pieces almost insipid, and of an orange or red colour. The the cellular coat is short, of the liber long-fibrous or stringy. Many of the arked by one or more oblique grooves or depressions apparently produced plant, and which are almost peculiar to this bark.

l, this bark, as found in commerce, is *trimmed;* that is, part of the outer n removed by rasping.[1] These trimmed pieces are somewhat smooth ex- ered with bark-dust, as if abraded from mutual friction, and present here at and angular marks, the result of the trimming process, and resembling n trimmed Russian rhubarb.

to colour, there are two sorts of lancifolia bark, one orange or yellow, d. *Orange lancifolia bark* is the standard sort, and to which the name of *rk* is exclusively applied. It is Guibourt's *quinquina orangé de Mutis.* The *a bark* is known in commerce as *red Carthagena bark.* It is Guibourt's *uge de Carthagène.* It is a New Granada bark, gathered from a tree growside with that which yields the orange lancifolia bark, and is employed by nufacturers in the preparation of quinidine. The trees which respectively two barks are probably varieties of the same species. A red lancifolia bark from Peru, and is of better quality, for, though not rich in alkaloid, it yields

ION.—This bark yields quinine, quinidine, and cinchonine, but in very va- rtions. In some sorts (*e. g.* the red Carthagena sort) the quinidine greatly es; and hence they are sometimes called "quinidine barks."

Howard suspects that Peretti's *pitayne* is identical with quinidine.

wing are the results of some experiments on Coquetta bark: —

–7000 grains of bark yielded 158 grains of alkaloid, soluble in pure washed 4 grains of alkaloid, insoluble in ether but soluble in alcohol. The 158 kaloid, when converted into disulphate of quinine, yield 112 grains of the salt.

— 7000 grains of bark furnished 158 grains of alkaloid, which yielded 126 ystallised disulphate of quinine.

— 7000 grains of bark gave 56 grains of alkaloid, which, converted into f quinine, yielded 36 grains of the crystallised salt.

lsley has kindly furnished me with his results obtained by operating on 1 lb. 0 grains) of bark: they are embodied with the preceding in the follow-

	7000 grs. of Bark.	*Disulphate of Quinine.*	*Quinidine.*	*Cinchonine.*
	oquetta bark	112	Undetermined	Undetermined.
	"	126	"	"
	"	36	"	"
ndsley	Coquetta bark	72·1	10·5	30·8
	Lancifolia trimmed	32·2	17·5	24·5
	Uncoated quill lancifolia	57·4	16·1	88·2

AL PROPERTIES.—Chemical analysis shows that this bark varies con- its strength; but in general it may be regarded as a moderately good

CINCHONÆ DURÆ DE CARTHAGENA.—CARTHAGENA HARD CINCHONA BARK.

ES.—*Quinquina de Carthagène jaune pale,* Guibourt; *China flava dura; China,* Bergen; *Quina amarilla* [*Bogotensium*], Mutis; *Quina jaune, Cascarilla-Mula* vel *Mula-Cascarilla,* Peruv. and Boliv.; *Yellow Bark of Carthagena bark.*

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his *Quinologia* (Germ. trans. p. 36) expresses his opinion that the stems and thick cinchona trees should be rasped, before peeling them, in order to get rid of

HISTORY.—This bark was first noticed by Mutis,[1] under the name of *quina amarilla*, or yellow bark of Bogota.

In English commerce the name of Carthagena bark is applied generally to the barks of *C. cordifolia*, and *C. lancifolia*.

BOTANY.—Hard Carthagena bark is the produce of *C. cordifolia var. α vera*, Weddell. This is proved by the evidence of both Guibourt and Bergen, the former of whom examined Humboldt's authentic specimens of Mutis's yellow bark; and the latter, the specimens in Ruiz's collection.

COMMERCE.—This bark is imported chiefly from New Granada, but sometimes from Peru and Bolivia. It usually comes over in drum-like serons of about 80 lbs. net, or in half-chests of about 70 lbs.

DESCRIPTION.—It occurs in fine, middling, and thick quills, and in flat pieces. The quills vary in diameter from three to eight lines, in thickness from half to one and a half lines, in length from five to nine, rarely to fifteen inches. The flat pieces are more or less twisted, arched, or warped (sometimes like pieces of dried horn) in drying, and are from a half to two inches broad, two to seven lines thick, and four to eight, rarely to twelve inches, long. Both quilled and flat pieces are met with either coated or uncoated. The coated pieces often bear considerable resemblance to Cusparia bark. Weddell compares the appearance of the derm of the quilled pieces to that of the bark of the same age of *C. pubescens*. The periderm or coat, which is usually more or less rubbed off, is thin, soft, somewhat corky, laminated, with irregular longitudinal furrows; transverse cracks are very rare. The epidermis is whitish, yellowish-white, or ash grey. In the flat pieces the periderm is sometimes rendered tuberculous by the development of small cellular masses between the periderm and the cellular coat. The uncoated pieces consist of the liber and cellular coat. On their external surface we frequently observe irregular, flexuous, longitudinal, but not very deep furrows. Here and there we perceive whitish or greyish spots arising from the persistence of shreds or fragments of the periderm. The internal surface varies from smoothish to fibrous: often the fibres project obliquely, giving the bark a scaly-fibrous appearance. The prevailing tint of the cortical layers is usually dull ochre-yellow. Externally the uncoated pieces are reddish or brownish-yellow. Internally the tint is brighter and more or less orange-coloured in the younger and fresh pieces: in older pieces it is more brownish. The transverse fracture short, externally suberous, internally more or less fibrous. The longitudinal fracture (which is with difficulty effected) is uneven, short, and in some pieces coarse-splintery. The taste is moderately bitter and astringent. The powder is cinnamon-coloured.

Some of the coarse uncoated quills are very smooth to the touch, and might well bear the name of *velvet bark*, which Humboldt says is applied to this bark by the common people in New Granada.

I have received from Sir William Hooker two sorts of hard Carthagena bark, differing but slightly from each other, accompanied with a note signed by Jose Manuel Restrepo, and dated Bogota, 13th of December, 1850. They are described as being the produce of two varieties of *C. cordifolia*:—

"*C. Cordifolia*, No. 1.—The fruit of this species is long, yellow, and abundant. It is found in the forests under a higher temperature than C. lancifolia, and is more luxuriant and thicker than the latter.

"*C. Cordifolia*, No. 2. The fruit is smaller than that of No. 1, and is black. The fibres of the leaves have but little red, and rather incline to green. Is this the *C. ovata* of Weddell?

"In some forests these two kinds of bark produce no sulphate of quinine. To what can this be owing? Probably to the nature of the soil or the age of the tree?"

CRYPTOGAMIA.—Very few cryptogamia are found on this bark. The following are those mentioned by Bergen:—

Lichenes.—*Trypethelium variolosum*; *Thelotrema bahianum*; *Pyrenula poronoïdes*; *P. discolor*; *Parmelia melanoleuca*; *Usnea florida δ Cinchonæ*.

COMPOSITION.—This bark yields quinidine and cinchonine. Weddell says that in France it has been found to yield a very small proportion only of cinchonine, and scarcely any quinine. But the reports of the German chemists are very different.

The following are the quantities of the cinchona alkaloids which Von Santen and Goebel and Kirst obtained:—

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[1] *Papel Periodico de Santa Fé de Bogota* [edited by Rodrigo Socorro], No. 89–128, 1793–1794.

	1 *lb. of Bark.*	*Cinchonia.*		*Sulphate of Quina.*
Von Santen	1. Quills and flat pieces (from Cadiz in 1814)	30 grs.	......	32 grs.
	2. Flat pieces (from Curaçao in 1806)	36 grs.	......	5 grs.

Goebel and Kirst found 56 grs. of Quina, and 43 grs. of pure Cinchonia.

The bark analysed under the name of *Carthagena cinchona*, by Pelletier and Caventou,[1] was *Carthagena brown cinchona*[2] (see *Pitaya Condaminea bark*, p. 118).

Gelatine occasions no precipitate in the infusion: tincture of galls produces turbidness: sesquichloride of iron a green colour.

MEDICINAL PROPERTIES.—These are greatly inferior to those of Calisaya bark, though, according to Weddell, Mutis declares that "Ea est species, quæ Chinæ auctoritatem perditam restituit, et quæ a tempore ejus introductionis, a. 1742, in medicina singulare pretium obtinuit."

XII. CORTEX CINCHONÆ DE MARACAIBO.—MARACAIBO BARK.

In 1831, Mr. Carpenter,[3] of Philadelphia, published some observations on a new variety of cinchona bark, called *Maracaibo bark*. In 1841, M. Guibourt met with, in commerce, large quantities of *Maracaibo cinchona* (quinquina de Maracaibo).

I have found in English commerce three barks under the name of "Maracaibo bark:"—

1. A root-bark which was given to me by Mr. J. E. Howard as "curly Maracaibo bark," and to which I have already referred (see *New Granada Cinchona Root-bark*, p. 91). It contains cinchonine.

2. A stem-bark consisting of short broken twisted quills and flat pieces, rarely more and usually less than three inches long. Some of the quills are entirely uncoated, and consist exclusively of liber. Other quills and flat pieces are partially covered externally by a greyish-white coat. This variety contains very little alkaloid, and is closely allied in appearance to the bark of *Cinchona cordifolia*. This probably is the sort referred to by Mr. Carpenter.

3. A very coarse powder or small fragments of the liber of a very bitter friable bark.

TABLE OF COMMERCIAL CINCHONA BARKS,

WITH THE BOTANICAL SPECIES FROM WHICH THEY ARE PRESUMED TO BE OBTAINED.

Name.	*Remarks.*	*Botanical Species.*
1. Genuine Calisaya or Yellow Bark (*Cinchona flava* [*regia*], Ph. Lond.)	Monopoly bark may be taken as the type	1. *Cinchona Calisaya var.* α *vera*, Weddell.
2. Josephian Calisaya Bark (*Ichu-Cascarilla*; *Cascarilla del Pajonal*, Boliv.)	Sold as Calisaya barks. Strictly speaking, they are false Calisaya barks	2. *C. Calisaya var.* β *Josephiana*, Wedd.
3. Bolivian Mulberry Calisaya (*Cascarilla morada*, Boliv.)		3. *C. Boliviana*, Wedd.
4. *Cascarilla-Carabaya*; *Zamba morada*, Peruv.	Except No. 7, these barks are not distinguished by any special names in English commerce; but are usually known as *spurious* or *false Calisaya barks*. In France the designation of *Calisaya léger* (light or flimsy Calisaya) is given to some of them (*e.g.* to Nos. 3, 5, and 6) ...	4. *C. ovata var.* β *rufinervis*, Wedd.
5. *Cascarilla provinciana*, Huanaco; *C. motosolo*, Carabaya; *Quepo-Cascarilla*, Boliv.		5. *C. micrantha*, Wedd.
6. *Cascarilla colorada del Cuzco*; *Cascarilla de Santa-Ana*, Peruv.		6. *C. scrobiculata var.* α *genuina*, Wedd.
7. Peruvian Calisaya		7. *C. scrobiculata var.* β *Delondriana*, Wedd.
8. *Cascarilla-Echenique*, Peruv.; *Cascarilla-Quepo*, Boliv.		8. *C. amygdalifolia* Wedd.
9. Carabaya Bark..........................	This is not to be confounded with No. 4. ...	9. *C. ovata var.* α *vulgaris*, Wedd.

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[1] *Journ. de Pharm.* vii. 101.

[2] Guibourt, *Hist. des Drog.* ii. 96.

[3] Silliman's *American Journal of Science and Arts*, vol. xx. p. 52, 1831.

TABLE OF COMMERCIAL CINCHONA BARKS—*continued.*

Name.	*Remarks.*	*Botanical Species.*
10. Cusco Bark (*Carua-carua*, Peruv.; *Cascarilla- or Quina-amarilla*, Carab.)........................	This is not to be confounded with the red Cusco bark, No. 6.......	10. *C. pubescens var.* α *Pelletieriana*, Wedd.
11. *Cascarilla morada*, Ruiz; *Cascarilla bobo de hojas moradas*, Huanuco ...	Occasionally imported with No. 10, and not distinguished by name from it.	11. *C. pubescens var.* β *purpurea*, Wedd.
12. Grey Bark; Huanuco or Lima Bark (*Cinchona cinerea*, Ph. Ed.):— α. Fine Grey bark (*Quinquina rouge de Lima*, Guib.) .... β. Inferior or Coarse Grey Bark (*Quinquina de Lima gris brun*, Guib.)	These two sorts of grey bark are not distinguished in English commerce; they are usually imported mixed together, but are sometimes brought over separately	12. α. *C. nitida*, Ruiz and Pavon. β. *C. micrantha*, Wedd.
13. Huamalies Bark; Rusty Bark		13. *C. Condaminea var.* β *Chahuarguera*, De Cand.?
14. Ash Bark (*Quinquina de Loxa cendré A*, Guib.; *Blasse Ten-China*, Bergen)	Not to be confounded with ashy crown bark (No. 18)..................	14. *C. ovata var.* α *vulgaris*, Wedd.
15. Original or True Crown Bark (*Cinchona pallida* [*de Loxa*], Ph. L.; *Cinchona coronæ*, Ph. Ed.)	In commerce these barks are called *Loxa* or *Crown Barks*.	15. *C. Condaminea var.* α *vera*, Wedd.
16. White Crown Bark		16. *C. Condaminea var.* γ *lucumæfolia*, Wedd.
17. H. O. Crown Bark		17. *C. glandulifera*, Ruiz and Pavon?
18. Ashy Crown Bark (*Quinquina de Loxa cendré B*, Guib.; *Dunkele Ten-China*, Bergen...........................		18. *C. cordifolia var.* β *rotundifolia*, Wedd.?
19. Wiry Loxa Bark		19. *C. hirsuta*, Ruiz and Pavon??
20. Red Bark (*Cinchona rubra*, Ph. Lond.)		20. *C.* ——?
21. Pitaya Condaminea Bark (*Quinquina Pitaya*, Guib.	Not distinguished by name in English commerce	21. *C. Condaminea var.* ε *Pitayensis*, Wedd.
22. Fibrous Carthagena Bark (*Quinquina orangé de Mutis*, Guib..........	The *Coquetta* or *Bogota Bark* is a variety of this	22. *C. Condaminea var.* δ *lancifolia*, Wedd.
23. Hard Carthagena Bark (*Quina amarilla*, Mutis)	This and the preceding bark are called *Carthagena Bark* in English commerce	23. *C. cordifolia var.* α *vera*, Wedd.
24. Maracaibo Bark, No. 2	....	24. *C. cordifolia*?
25. Bolivian Cinchona Root Bark.........	Both these root barks are in short, contorted, twisted pieces.	25. *C. Calisaya var. Josephiana*, Wedd.
26. New Granada Cinchona Root Bark; Curly Maracaibo Bark		16. *C.* —— ?

The barks enumerated in the above table, and which have been previously described, yield very unequal quantities of the cinchona alkaloids, and, therefore, in a medicinal point of view, are of very different qualities. The following are, according to M. Guibourt, the most active barks:—

1. Calisaya bark.
2. Orange-yellow [includes *C. micrantha*, see *ante*].
3. Pitaya [Pitaya Condaminea, see *ante*].
4. Red genuine, verrucous [see *ante*].
5. Red genuine, non-verrucous [see *ante*].
6. Red Lima [Fine Grey, see *ante*].
7. Grey Lima [Inferior Grey, see *ante*].
8. Huamalies. white verrucous [see *ante*].

[M. Delondre has recently examined the amount of the alkaloids contained in 1 kilogramme (about 2⅗ pounds troy) of the different sorts of bark, and the results of his investigations are embodied in the following table:—

Bark.	Sulphate of Quinine.		Sulphate of Cinchonine.	
	Grammes.	Grains.	Grammes.	Grains.
Calisaya flat, with epidermis	30 to 32	463 to 466	6 to 8	92 to 123
Calisaya in quills	15 to 20	231 to 308	8 to 10	123 to 154
Carabaya	15 to 18	231 to 277	4 to 5	61 to 77
Carthagena orange yellow of Mutis	15 to 16	231 to 147	6 to 8	92 to 123
Yellow bark of Mutis	12 to 14	185 to 216	5 to 6	77 to 92
Red bark of Mutis	12 to 14	185 to 216	6 to 7	92 to 108
Cusco	4	61	12	185
Pitaya	20 to 25	308 to 386	10 to 12	123 to 185
Calisaya from Santa Fé de Bogota	30	463	3 to 4	46 to 61
Maracaybo	2 to 3	30 to 46	10 to 12	154 to 185
Red bark from Guyaquil	20 to 25	308 to 386	10 to 12	154 to 185
Pale red bark	15 to 18	231 to 277	5 to 6	77 to 92
Yellow bark from Guyaquil	3 to 4	46 to 61	30	463
Quilled orange yellow	18	277	4 to 5	61 to 77

—ED.][1]

COMPOSITION.—In February 1791 Fourcroy[2] published an analysis of *St. Lucia* or *St. Domingo bark* (a false cinchona bark yielded by *Exostemma floribundum*), which was long regarded as a model of vegetable analysis. In 1802 Seguin[3] concluded, that, as the active principle of cinchona was precipitated by an infusion of nutgalls, it must be gelatine; and therefore proposed and employed the use of clarified glue as a febrifuge in intermittents! In 1803 Dr. Duncan, jun.[4] showed that the active principle could not be gelatine, but must be a substance *sui generis*, which he therefore termed *cinchonia*. In 1806 Vauquelin[5] published some experiments on seventeen kinds of cinchona. In 1810 Gomes[6] succeeded in isolating *cinchonia*, and obtaining it in a crystalline form. In 1820 Pelletier and Caventou[7] announced the existence of two cinchona alkaloids—*cinchonia* and *quinia*—in cinchona bark. In 1829 Pelletier and Coriol[8] discovered a third cinchona alkaloid—*aricina*—in a new sort of cinchona bark, which they termed *Arica bark* (the bark of *Cinchona pubescens var. α Pelletieriana*, Weddell). In the same year (1829) Serturner[9] gave the name of *quinoidine* (chinoïdine) to another supposed peculiar alkaloid contained in yellow and red barks; the existence of which, however, was denied by Henry fils and Delondre.[10] In 1833[11] the last-mentioned chemists announced a new cinchona alkaloid, called *quinidine*, which they obtained from yellow bark, and which was doubtless contained in Serturner's quinodine: but, finding its composition to be identical with quinia, they subsequently[1] stated that their supposed new alkaloid, quinidine, was nothing else than hydrate of quinine. In 1846 Liebig[2] declared that a considerable portion of the resinous-looking body called quinoidine, which the makers of sulphate of quinine obtain from their mother waters, was *amorphous quinine*, and bore the same relation to ordinary quinine that barley-sugar does to sugar-candy. In 1148 a Dutch chemist, Van Heijningen,[3] submitted quinoidine to a careful examination, and found in it *quinidine*, or, as he termed it, β *quinine;* and the year following (1850) he obtained from it another alkaloid, which he called γ *quinine.*[4]

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[1] *Pharm. Journal*, vol. xiv. pp. 83, 168.

[2] *Ann. de Chim.* viii. 113; and ix. 13.

[3] *Ibid.* xcii. 121; and xci. 273 and 304.

[4] *Nicholson's Journal*, vi. 225.

[5] *Ann. de Chim.* lix. 113.

[6] *Mem. da Acad. Real das Sciencias de Lisboa*, iii. 201; and *Ed. Med. and Surg. Journ.* vii. 420.

[7] *Journ. de Pharm.* t. vii. p. 49, 1821.

[8] *Ibid.* t. xv. p. 565, 1829.

[9] *Ibid.* t. xvi. p. 44, 1830.

[10] *Ibid.* t. xvi. p. 144, 1830.

[11] *Ibid.* t. xix. p. 623, 1833.

The organic constituents of the cinchona barks, as determined by Pelletier and Caventou, and subsequently by the chemists, are *quina, cinchonia, aricina, quinidine, kinic, tannic,* and *kinovic acids, cinchona red, yellow colouring matter, green fatty matter, starch, gum,* and *lignin.*

Puttfarcken[5] found that, by incineration, the cinchona barks yielded from 0·58 (yellow or Calisaya bark) to 3·4 (ash cinchona) per cent. of ashes, the chief constituent of which was carbonate of lime. Some barks (*e. g.* Calisaya and Huanuco) yielded ashes of a green colour, owing to the presence of manganate of potash. Puttfarcken's results favour the opinion that with the increase of the alkaloids in the barks, the proportion of lime diminishes.

[M. Delondre concludes from his experiments,—

1st. That the leaves and fruit of the Cinchonas do not contain the alkaloids found in the bark of the trunk and roots.

2nd. That the bark of the roots contains a smaller proportion of these alkaloids than the bark of the trunk and branches.

3rd. That the liquids obtained by incision contain the same substances as are extracted from the bark by water.[6]—ED.]

1. VOLATILE OIL OF CINCHONA BARK (*Odorous, Aromatic,* or *Balsamic Principle.*)—This was procured first by Fabbroni,[7] afterwards by Tommsdorff.[8] It was obtained by submitting bark with water to distillation. The distilled water had the peculiar odour of the bark, and a bitterish acrid taste. The oil which floated on the water was thick and butyraceous, and had the peculiar odour of the bark, and an acrid taste. From 20lb. of bark, Trommsdorff obtained two grains of oil. Zenneck[9] says the cinchona odour is imitated by a solution of turmeric in potash, as well as by chloride of iron.

2. CINCHONO-TANNIC ACID (*Tannic Acid; Astringent Principle; Soluble Red Colouring Matter*).—Cincho-tannic acid differs from the tannic acid of nutgalls in being less astringent, in yielding a green colour or precipitate with the salts of the sesquioxide of iron, and in the remarkable facility with which its solution absorbs the oxygen of the air, especially under the influence of alkalies. Furthermore, the compounds which it forms with acids are more soluble than those of the nutgall tannic acid. According to Schwarz,[10] the formula of the hydrate of cincho-tannic acid is

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[1] *Journ. de Pharm.* t. xx. p. 157, 1834.

[2] *Lancet*, p. 585, May 23, 1846; *Ann. d. Chem. u. Pharm.* Bd. lviii. S. 348, 1846.

[3] *Pharmaceutical Journal*, vol. ix. p. 322, 1850.

[4] *Ibid.* vol. xi. p. 521, 1852.

[5] *Ibid.* vol. xi. p. 129, 1851.

[6] *Ibid*, vol. xiv. p. 80.

[7] *Berl. Jahrb.* 1807.

[8] Buchner's *Repert.* Bd. xviii. S. 223, 1824.

[9] *Pharm. Central-Blatt für* 1832, S. 236.

[10] *Pharmaceutical Journal*, vol. xii. p. 17, 1852.

$I^6O^7+2HO=C^{14}H^8O^9$. The products of the oxidation of this acid are, according he same authority, 1 eq. of cinchona red, $C^{12}H^7O^7$, 2 eq. of carbonic acid, $2CO^2$, 1 eq. of water, HO. So that it must absorb 3 eq. of oxygen.

. CINCHONA RED (*Red Cinchonic; Insoluble Red Colouring Matter*).—Berzelius[1] Schwartz regard this substance as a product of the oxidation of cincho-tannic acid. an inodorous, insipid, reddish-brown substance, insoluble, or nearly so in cold er, somewhat more soluble in hot water, but readily soluble in alcohol and alkalies. obtained by Schwartz, it also dissolved easily in ether. Acids favour its solution water. Its alkaline solution is intensely red. Dried at 212° Schwartz found it to sist of $C^{12}H^7O^7$.

n the previous edition of this work I expressed an opinion that red cinchonic embled in most of its properties catechuic acid (catechine), which is found in ndance in another genus of cinchonaceous plants (*see Uncaria Gambir*). Pelouze Frémy[2] assert that "the tannin contained in cinchona is nothing else than cateic acid, and red cinchonic is a product of its oxidation which precedes the formation ubinic acid."

. KINIC ACID (*Cinchonic* or *Quinic Acid*). $C^7H^4O^4,2HO$.—Exists in cinchona ks in combination probably with the cinchona alkaloids and with lime. It crysises from its aqueous solution in prisms with rhombic bases. Its presence may be readily detected by converting it into *kinone* ($C^{12}H^4O^4$). This is done by subting the substance supposed to contain kinic acid to distillation with peroxide of nganese and sulphuric acid: the kinone distils over. It is a yellow crystallisable stance, soluble in water, and having a pungent odour. If its watery solution be ted with ammonia, it absorbs oxygen from the air, and becomes first brown, and lly black,—owing probably to the formation of melanic acid. ($C^{12}H^4O^4+2O=$ H^4O^6.) If chlorine water be added to another portion of the solution of kinone, liquid assumes a bright green colour. Dr. Stenhouse[3] has proposed to detect the ence of kinic acid in cinchona bark by converting it into kinone.

. KINOVIC ACID (*Kinova Bitter; Chiococeic Acid.*) $C^{12}H^9O^3$.—Has been found in aya bark, as well as in the false cinchona bark called *quinquina nova*. It exists in latter bark most probably in combination with lime.[4] It is a white amorphous tance, almost insoluble in water, but readily soluble in alcohol and ether. A solution he kinovate of magnesia yields precipitates (*kinovates*) with solutions of acetate of , bichloride of mercury, and the salts of cinchonia. Kinovic acid is devoid of ifuge power.[5]

CINCHONA ALKALOIDS.—Three alkaloids obtained from genuine cinchona barks been used in medicine; viz. *Quina*, *Cinchonia*, and *Quinidina*. *Aricina*, another imperfectly known cinchona alkaloid, has not hitherto been applied to medicinal oses.

he cinchona alkaloids exist in cinchona bark in combination with one or more acids; ably with kinic and tannic acids: according to Henry fils and Plisson,[6] with kinic and cinchona red. They reside chiefly in the liber (see *ante*, p. 84).

nchonia, quina, and aricina, were regarded by Pelletier as being respectively the oxide, binoxide, and teroxide of an hypothetical nitrogenous base, which he called gen, and whose formula is $C^{20}H^{12}N$.

he following are the formulæ and equivalents for those cinchona alkaloids which been best studied:—

Cinchona Alkaloids.	*Formulæ.*	*Equivalents.*	*Authority.*
Quinidina	$C^{38}H^{22}N^2O^2$	216	Leers.
Quina	$C^{38}H^{22}N^2O^4$	300	Laurent.
	$C^{20}H^{12}NO^2$	162	Liebig.
Cinchonia	$C^{38}H^{22}N^2O^2$	284	Laurent.
	$C^{20}H^{12}NO$	154	Liebig.

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[1] *Traité de Chimie*, t. v. p. 585, 1831.

[2] *Cours de Chimie Générale*, t. iii. p. 171, 1850.

[3] *Memoirs of the Chemical Society of London*, vol. ii. p. 226, 1845.

[4] Hlasiwetz, *Chemical Gazette*, vol. ix. p. 441, Dec. 1, 1851.

[5] Weil, Buchner's *Repertor*, 2te Reihe, Bd. iii. S. 396, 1835.

[6] *Journal de Pharmacie*, t. xiii. pp. 269 and 369, 1827.

TABLE, SHOWING THE PER-CENTAGE AMOUNT OF ALKALOIDS OBTAINED FROM THE OFFICINAL BARKS OF THE BRITISH PHARMACOPŒIAS.

100 *Parts of Bark.*	*Quina.*	*Quinidina*	*Cinchonia*	*Total Alkaloid.*	*Authority.*
CALISAYA :—					
Average produce (see *ante*)	2·2 to 2·6	......	......	......	Pelletier and Soubeiran.
Uncoated thick flat pieces	2·14	......	......	......	Winckler.
Best sort	3·8	......	......	......	Riegel.
Var. β *Josephiana*	3·29	......	......	......	Riegel.
RED BARK :—					
Best sort	2·65	......	1·51	4·16	Riegel.
Large broad flat pieces	......	......	......	3·85	Riegel.
Dark heavy flat-coated pieces......	0·104	......	2·34	......	Winckler.
Pale thin flat pieces................	0·078	......	1·04	......	Winckler.
LOXA OR CROWN :—					
Fine old Loxa quills, in bundles...	0·714	0·514	0·04	1·268	J. E. Howard.
Finest Crown	0·52	......	0·42	0·94	Riegel.
H. O. Crown, fine sample, 1850...	......	0·57	0·06	0·63	J. E. Howard.
Ditto ditto 1851...	......	1·05	0·08	1·13	J. E. Howard.
Ashy Crown, from Lima............	0·5		0·914	1·414	J. E. Howard.
Ashy Crown mixed with Ashy Crown from Lima	0·4 (chiefly quinidina)		0·285	0·685	J. E. Howard.
GREY OR HUANUCO :—					
Fine Grey........	0·571	0·142	1·4	2·113	J. E. Howard.
Inferior or coarse grey	0·243	0·28	1·25	1·773	J. E. Howard.
Strong middling-sized quills	......	......	2·5	......	Winckler.

1. QUINA.

Quina; Quinininum; Chininum; Quinine. Formula $C^{38}H^{22}N^2O^4$ (Laurent[1]). Eq. 370. Symb. $\overset{+}{Qn}$.—Discovered in 1820 by Pelletier and Caventou. It is a probable constituent of all genuine cinchona barks, but especially of the genuine yellow bark (*Cinchona Calisaya*), from which it is chiefly obtained. It is also procured by chemical manufacturers from the cheaper but inferior cinchona barks of Carabaya, Bolivia, and New Granada.

The simplest, readiest, and cheapest mode of procuring quina is by adding ammonia to a solution of the sulphate of quina and collecting and drying the precipitated quina.

As usually procured, quina is in the form of a whitish, porous mass. Pelletier crystallised it by dissolving it in alcohol of sp. gr. 0·815, and setting the solution aside to evaporate spontaneously in a dry place. Liebig obtained it from a somewhat ammoniacal watery solution, in the form of fine silky needles. Quina crystallised from its aqueous solution is a *hydrate*, and has for its formula $\overset{+}{Qn},6HO{=}C^{38}H^{22}N^2O^4,6HO$.

Quina is inodorous, very bitter, and fusible at about 300° F. The fused mass, when cold, is yellow, translucent, friable, and somewhat like resin in appearance. One part of quina requires about 400 parts of cold water, or 250 parts of boiling water, or 2 parts of boiling alcohol and 60 parts of cold ether to dissolve it. The aqueous and alcoholic solutions react as an alkali. Dissolved in either alcohol or acidulated water, quina possesses the property of left-handed rotatory polarisation. At a temperature above 72° F. this rotatory power decreases.

When quina is distilled with excess of potash, an oily liquid base, called *quinoline* or *cincholine*, $C^{18}H^7N$, is obtained. Some other organic bases, as cinchonia and strychnia, also yield, when distilled with potash, the same product. Dr. Stenhouse[2] has proposed to detect the presence of an alkaloid in bark by this test.

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[1] *Ann. de Chim. et de Phys.* 3d Sér. t. xix. pp. 359-377, 1847. Liebig's formula is $C^{20}H^{12}NO^2$: equiv. 162.

[2] *Memoirs of the Chemical Society*, vol. ii. p. 227, 1845.

Quina and its salts may be readily detected by the following test:—if the alkaloid its salt be diluted with water, and chlorine water be then added, the alkaloid is dis- ved without producing any remarkable effect. But if ammonia be now added, the uid acquires a grass-green colour.[1] By this colour quina may be distinguished from chona and quinidina. If a substance suspected to contain quina be powdered, then aken with ether, and afterwards successively treated with chlorine and ammonia, the uid will assume a green colour if the slightest trace of quina be present.

The *salts of quina* are of two classes,—one termed *neutral*, the other *acid*: the former ntain one, the latter two, equivalents of acid to each equivalent of base.[2] They are r the most part readily crystallisable, very bitter, and of a pearly aspect. The less lable salts are the *oxalate*, the *tartrate*, the *tannate*, and *ferrocyanate*. The soluble lts are more bitter than the corresponding salts of cinchonia. They yield precipitates the addition of tannic acid (or tincture of nutgalls), ammonia, bichloride of mercury, d bichloride of platinum. Hyposulphite of soda causes a white crystalline precipitate *yposulphite of quina*) when added to a solution of hydrochlorate of quina. According Winckler,[3] neither amorphous quina nor amorphous cinchonia, when saturated with ydrochloric acid, yields any precipitate with the hyposulphite of soda.

The following is the composition of quina:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Laurent.*	*Liebig.*	*Pelletier and Dumas.*
Carbon	38	228	73·54	73·54	74·40	75·02
Hydrogen	22	22	7·09	7·07	7·61	6·66
Nitrogen	2	28	9·03	—	8·11	8·45
Oxygen	4	32	10·33	—	9·88	10·43
Anhydrous Quina	1	310	99·99	100·00	100·00	100·56

AMORPHOUS QUINA.—A supposed uncrystallisable form of quina contained in the ther-liquors from which sulphate of quina has crystallised, and which is usually nd in the substance called *quinoidine*. Liebig[4] considers that it bears the same re- ion to crystallisable quina that barley sugar does to sugar candy; and Winckler[5] states t ordinary quina may be rendered amorphous by the action of acids. He further orms us that the amorphous cinchona alkaloids (quina and cinchonia) may be distin- shed and separated from the crystalline alkaloids by hyposulphite of soda, which pre- itates the latter, from their muriatic solution, in the form of crystalline hyposul- tes, but occasions no precipitate with corresponding solutions of the amorphous aloids.

Some doubts, however, still exist as to the real nature of the so-called amorphous na. Roder[6] declares that it is merely ordinary quina combined with a resin; while Heijningen[7] resolved the so-called quinoidine into ordinary quina, cinchonia, nidina, and a resinous substance.

Dilute solutions of quina (especially an acidulated aqueous solution of the commer- sulphate) exhibit in certain aspects a peculiar celestial blue colour. This property been denominated, by Professor Stokes,[8] *fluorescency*. Sir John Herschel[9] considered it to be a case of *superficial*, or, as he termed it, *epipolic* (from ἐπιπολή, *a surface*) *dispersion*. Sir D. Brewster,[1] however, showed that the effect was not confined to the surface, but extended to a considerable depth into the body of the liquid, and he, therefore, regarded it as a particular case of *internal dispersion*. More recently, Professor Stokes has shown reason for concluding that in this process of true internal dispersion the chemical or invisible rays of the spectrum, which are more refrangible than the violet rays, change their refrangibility, thereby becoming visible, and produce the blue superficial light in question.[2]

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[1] Messon (by mistake printed Roper), in the *Lond. Med. Gaz.* vol. xi. pp. 320 and 362; in the *Phil. Mag.* Feb. 1835; André, *Journ. de Pharm.* xxii. 127, 1836. The green duct of the action of chlorine and ammonia on quina has been called by Brandes and er (*Pharm. Central-Blatt für* 1838, p. 875), *dalleiochin*, $C^{15}H^{10}NO^{3}$ (more properly *thalleio-*, from θαλλειν). They also mention two other products of decomposition; one termed ochin, and the other *rusiochin*.

[2] If Liebig's formula for quina be adopted, the above two classes of salts would be called pectively *basic* and *neutral*, although the latter possess an acid reaction. The duplication the equivalent for quina, as suggested by Regnault, necessarily alters the nomenclature of salts.

[3] *Chemical Gazette*, vol. vi. p. 122, 1848.

[4] *Lancet.*

[5] *Chemical Gazette*, vol. vi. p. 121, 1848.

[6] *Pharmaceutical Journal*, vol. viii. p. 295, 1848.

[7] *Ibid.* vol. ix. p. 322, 1850.

[8] *Philosophical Transactions* for 1852.

[9] *Ibid.* for 1845.

1. QUINÆ SULPHAS (*Quinæ Disulphas*, Ph. Lond.) See *post*.

2. QUINÆ BISULPHAS. Formerly called *Neutral Sulphate of Quina*. Formula[3] $(\overset{+}{\mathrm{Qn}},\mathrm{HO}),2\mathrm{SO}^3,+16\mathrm{HO}=(\mathrm{C}^{38}\mathrm{H}^{22}\mathrm{N}^2\mathrm{O}^4,\mathrm{HO}),2\mathrm{SO}^3=16\mathrm{HO}$. Eq. weight 543.—This salt is readily formed by adding sulphuric acid to the sulphate. It is sometimes produced in the manufacture of the latter salt, and remains, on account of its greater solubility, in the mother liquor, with the sulphate of cinchonia. It crystallises in rectangular prisms or silky needles, reddens litmus, and dissolves in about 11 parts of water at ordinary temperatures, and also in spirits of wine. When heated, it melts in its water of crystallisation, and at 212° loses, according to both Baup and Liebig, 24·6 per cent. of water. It is distinguished from the ordinary sulphate by its acid reaction and its greater solubility in water. Its solution is fluorescent, and possesses the property of left-handed rotatory polarisation. With sulphate of the sesquioxide of iron it forms a double salt, which crystallises in octohedra resembling those of alum.

2. CINCHONIA.

Cinchonine; *Cinchonina*; *Cinchoninum*. Formula $\mathrm{C}^{38}\mathrm{H}^{22}\mathrm{N}^2\mathrm{O}^2$, Laurent.[4] Equiv. 294. Symbol $\overset{+}{\mathrm{Ci}}$.—Its presence was inferred in 1803 by Dr. Duncan, Jun.; but Gomes first succeeded in obtaining it in 1810. It is a probable constituent of all genuine Cinchona barks, but is met with most abundantly in Cusco and Grey barks. It is obtained from the sulphate of cinchonia in the same way that quina is procured from its sulphate.

Cinchonia readily crystallises from its alcoholic solution. The crystals are anhydrous, colourless, inodorous, and bitter, though less so than quina. Their shape is that of a four-sided prism, with oblique terminal facets. It fuses, but with more difficulty than quina, and, by the cautious application of heat, it is volatilised, and yields a crystalline sublimate. During its sublimation it evolves an aromatic odour (by which, according to Liebig, it is distinguished from quina). Heated with potash it yields cinchonine.

It is less soluble in water, alcohol, and ether, than quina. Thus cold water scarcely dissolves any of it, and boiling water takes up only $\frac{1}{2500}$th part of its weight. It is somewhat soluble in spirit of wine, and the more so in proportion as the spirit is stronger and its temperature higher. According to Duflos, strong spirit of wine dissolves only 3 per cent. of its weight of cinchonia. In ether it is insoluble, and by this property it is both distinguished and separated from quina. Cinchonia dissolved either in alcohol or in acidulated water possesses the property of right-handed rotatory polarisation, and is thereby distinguished from quina, whose rotation is left-handed.

Cinchonia or its salts dissolve in chlorine water without undergoing any obvious change. In this respect it agrees with quina or quinidina. But if ammonia be added to the solution, a white precipitate is produced. By this latter character cinchonia is distinguished from both quina and quinidina.

Of the salts of cinchona those which are interesting in a medicinal point of view are the two sulphates.

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[1] *Edinburgh Transactions*, vol. xvi. part ii. 1846; also *Lond. Edinb. and Dubl. Philosoph. Mag.* for June 1848.

[2] For an abstract on the views of Herschel, Brewster, and Stokes, see the *Pharmaceutical Journal*, vol. xii. p. 245, 1852.

[3] Regnault (*Cours Elément. de Chimie*, 2me édit. 4me part. p. 720, 1850,) gives the following formula for this salt:—$(\mathrm{C}^{38}\mathrm{H}^{24}\mathrm{N}^2\mathrm{O}^4,\mathrm{HO}), 2\mathrm{SO}^3+8\mathrm{HO})$. This would give only 15 per cent. for the water of crystallisation. It is probable, therefore, that the "8HO" is a misprint for "16HO."

[4] *Ann. der Chemie u. Pharm.* Bd. lxii. p. 99, 1847.—Liebig's formula for it is $\mathrm{C}^{20}\mathrm{H}^{12}\mathrm{NO}$, and its corresponding equivalent 154.

1. **CINCHONIÆ SULPHAS**; *Sulphate of Cinchonia; Cinchoniæ Disulphas.* Formula $(\overset{+}{Ci},HO),SO^3,2HO=(C^{38}H^{22}N^2O^2HO),SO^3+2HO$. Eq. weight 361. The sulphate of cinchonia of commerce is usually obtained from the mother waters from which sulphate of quina has crystallised. The crystals of this salt are short, oblique prisms, terminated by dihedral summits. Its taste is bitter. When heated it becomes phosphorescent: at 212° it fuses; at 248° F. it loses its water of crystallisation. At ordinary temperatures it is soluble in 6½ parts of alcohol of sp. gr. 0·85, and in 11½ parts of absolute alcohol. It requires 54 parts of cold water to dissolve it. Its solution possesses the property of right-handed rotatory polarisation; and is not fluorescent. By these properties it is distinguished from the sulphates of quina and quinidine. In ether it is insoluble.

2. **CINCHONIÆ BISULPHAS**; *Bisulphate of Cinchonia.* Formerly called the *Neutral Sulphate of Cinchonia.* Formula $(\overset{+}{Ci},HO),2SO^3,+8HO=(C^{38}H^{22}N^2O^2,HO),2SO^3,+8HO$. Eq. weight 455.—Obtained by dissolving the sulphate in water acidulated with sulphuric acid, and evaporating the solution so that crystals may form. These are rhomboidal octohedra which, in dry air, become opaque and efflorescent. When heated they lose their water of crystallisation. At ordinary temperatures 100 parts of this salt dissolve in 46 parts of water, in 90 parts of rectified spirit sp. gr. 0·85, or in 100 parts of absolute alcohol. It is insoluble in ether. The optical properties of a solution of this salt resemble those of a solution of the neutral sulphate of cinchonia.

3. QUINIDINA.

Quinidia or *Quinidine; Chinidin; β Quinine; Cinchotin.* Formula $C^{36}H^{22}N^2O^2$ (Leers). Eq. weight 282: $C^{20}H^{12}NO^2$ Van Heijningen, Hlasiwetz. Symbol $\overset{+}{Q}dn$.—In 1833, Henry and Delondre[1] discovered this alkaloid, to which they gave the name of *quinidine*; but, in the following year,[2] they declared it to be identical with quina. It is probable, however, that Bucholz[3] in 1822, and Thiel[4] in 1823, had actually obtained it, though in an impure form. In 1848, Van Heijningen[5] recognised it as a peculiar base which possessed the same composition as quinine. He, therefore, called it *β quinine* to distinguish it from ordinary quinine, which he termed *α quinine*. His statement as to its composition was confirmed in 1850 by Hlasiwetz,[6] who called it the alkaloid *cinchotin*. Winckler,[7] in 1848, gave a description of it and of some of its salts; and, in 1852, Leers[8] published a very elaborate account of its salts.

It is found in many, perhaps in most, of the genuine *Cinchona* barks; especially in *lancifolia*, *ovata*, *cordifolia*, and *amygdalifolia* barks.[9] It is obtained from them by the same process as that by which quina is procured from the quina-yielding barks; but its sulphate, being more soluble than sulphate of quina, is left in the mother waters. In order to obtain the alkaloid pure it is to be repeatedly crystallised from its alcoholic solution to deprive it of a greenish yellow resinous substance, and then shaken with ether, to remove any adherent quina, until the ethereal liquor no longer indicates the presence of quina by yielding a green colour on the addition first of chlorine water, and afterwards of ammonia.

Quinidina readily crystallises by the spontaneous evaporation of its solution in alcohol. The crystals are anhydrous, colourless, hard prisms, with a vitreous lustre. Their taste is bitter, but less so than that of quina. When heated in a platinum crucible over the flame of the spirit lamp they at first retain their shape and lustre, and then fuse, without either decomposing or giving out water, at 347° F., and form a clear wine-yellow liquid, which, by cooling, congeals into a whitish grey crystalline mass. If the heat be raised above 347°, the liquid takes fire and burns with a very sooty flame, and evolves an odour of quinole and of oil of bitter almonds. One part of quinidina is soluble in 2580 parts of water at 62½° F., or in 1858 parts of boiling water, or in 12 parts of alcohol, sp. gr. 0·835 at 62½° F. (in boiling spirit it is freely soluble), or in about 142 parts of ether at 62½° F. From both its alcoholic and ethereal solutions it readily crystallises.

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[1] *Journ. de Pharm.* t. xix. p. 623, 1833.

[2] *Ibid.* t. xx. p. 157, 1834.

[3] Trommsdorff's *Journ. der Pharm.* Bd. vi. p. 94, 1822.

[4] Geiger's *Magazin der Pharm.* I. Jahrg. Bd. ii. p. 79, 1823.

[5] *Pharmaceutical Journal*, vol. ix. p. 322, 1850.

[6] *Chemical Gazette*, vol. ix. p. 90, 1851.

[7] *Pharmaceutical Journal*, vol. vii. p. 527, 1848. Some other notices of quinidine by Winckler will be found in the same journal, vol. iv. p. 468, 1845, and the *Chemical Gazette*, vol. vi. p. 164, 1848.

[8] *Pharmaceutical Journal*, vol. xii. 1852.

[9] Winckler obtained it from a bark which he says somewhat resembled Huamalies bark. This probably was *Carabaya bark.*

A solution of quinidina in acidulated water agrees with one of quina, both in possessing the property of left-handed polarisation, and in being fluorescent. These properties distinguish it from a solution of cinchonia.

If the solution of quinidina be treated first with chlorine water, and then with ammonia, it does not become green like a solution of quina. It either yields a white precipitate like a solution of cinchonia, or, when a considerable excess of chlorine has been used, remains apparently unchanged.

The salts of quinidina are, for the most part, more soluble in water than those of quina. They readily dissolve in spirit of wine, but scarcely at all in ether. Like those of quina and cinchona the salts of quinidina are of two kinds, the one neutral, the other acid salts.

1. QUINIDINÆ SULPHAS; *Sulphate of Quinidine.* Formula $\overset{+}{\mathrm{Q}}\mathrm{dn},\mathrm{SO^4H},+6\mathrm{aq.}=(\mathrm{C^{36}H^{22}N^2O^2}),\mathrm{SO^4H},+6\mathrm{aq.}$[1] Eq. weight 403.—This salt crystallises in long, silky, shining acicular crystals, which dissolve in 130 parts of water at 62½° F., or in 16 parts of boiling water. It is readily soluble in two parts of rectified spirit; but it is almost insoluble in ether. Zimmer[2] states that in dry warm air it parts with its water of crystallisation without delinquency or losing its crystalline aspect. Its aqueous solution agrees with a solution of sulphate of quina, in being fluorescent, and in possessing the property of left-handed rotation polarisation.

In appearance this salt closely resembles sulphate of quina. Winckler,[3] indeed, says it is undistinguishable from the latter salt: but Zimmer states that it differs from the latter in having a greater sp. gravity and less flocculent crystallisation. It appears to me also to have a more vitreous lustre. It differs also in its much greater solubility both in water and in rectified spirit. Moreover, if its solution be successively treated with chlorine-water and ammonia it does not yield a green colour as a solution of sulphate of quina.[4] Furthermore, if a solution of sulphate of quinidina be decomposed by ammonia, the precipitated alkaloid (quinidina) may be readily distinguished from quina by its more difficult solubility in ether (see *Quinæ Sulphas*).

From sulphate of cinchonia, the sulphate of quinidina is readily distinguished by the appearance of its crystals, by the difference of its solubility in water, in alcohol, and in ether, and by its solution being fluorescent and possessing the property of left-handed rotatory polarisation.

2. QUINIDINÆ BISULPHAS; *Bisulphate of Quinidine; Acid Sulphate of Quinidine.* Formula $\overset{+}{\mathrm{Q}}\mathrm{dn},2(\mathrm{SO^4H}),12\mathrm{aq.}$ Eq. weight 488. Obtained by adding sulphuric acid to the neutral salt. It consists of an asbestus-like mass of fine acicular crystals. By drying at 212° they lose 19 per cent. of water (Winckler).

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[1] Van Heijningen's formula, as corrected by the editors of the *Ann. der Chemie* (Bd. lxxii. p. 304) is $2(\mathrm{C^{20}H^{12}NO^2}),\ \mathrm{SO^4H},+6\mathrm{aq.}$ This would indicate 12·6 per cent. of water; the quantity obtained by Van Heijningen being 12·84 per cent. But Winckler (*Pharm. Journ.* vol. vii. p. 531,) found 17·51988 per cent. of water in the crystallised salt, and 5·7777 per cent. in the efflorescent salt. The formula in the text represents 17·86 per cent. of water. The formula for the salt dried at 212° is, according to Leers, $(\mathrm{C^{36}H^{22}N^2O^2}),\mathrm{SO^4H}$.

[2] *Pharmaceutical Journal*, vol. xi. p. 394, 1852.

[3] *Ibid.* vol. vii. p. 631, 1848.

[4] Commercial sulphate of quinidina usually contains sulphate of quina, and in consequence its solution becomes green when successively treated with chlorine-water and ammonia.

PARATIVE TABLE OF SOME DISTINGUISHING PROPERTIES OF QUINA, QUINIDINA, AND CINCHONIA.

	Quina.	*Quinidina.*	*Cinchonia.*
ydrous alkaloid is	Amorphous (the hydrate crystallises with difficulty).	Crystalline (crystallises from tne alcoholic solution).	Crystalline (readily crystallises from the alcoholic solution).
....	Very bitter	Bitter (less intensely so than quina).	Bitterish, unpleasant (somewhat analogous to sulphate of magnesia).
properties solution of kaloid ...... Fluorescency	Fluorescent...............	Fluorescent?	Not fluorescent.
Rotatory polarisation	Left-handed	Left-handed	Right-handed.
lity part ka. in — Cold water	In 400 parts...............	In 2580 parts	Almost insoluble.
Boiling water...............	In 250 parts...............	In 1858 parts	In 2500 parts.
Cold rectified spirit Boiling rectified spirit	In 2 parts of boiling spirit: the solution does not deposit any thing when cold.	In 12 parts of cold spirit: the alkaloid is much more soluble in boiling spirit.	In 33 parts. Insoluble.
Cold ether	In 60 parts.		
	Uncrystallisable.	Soluble—crystallisable.	Insoluble.
tion of the alkaloid (*e. g.*, e sulphate in water) treatst with chlorine-water, then ia...............	Becomes emerald green.	Remains unchanged, or yields a white precipitate.	Becomes pinkish, and yields a white precipitate.
lity part e ame e aid — Cold water	In 740 parts...............	In 130 parts	In 54 parts.
Boiling water	In 30 parts	In 10 parts.	
Cold rectified spirit	In 60 parts	Easily soluble	In 6⅓ parts [in 11⅓ parts of anhydrous alcohol].
Boiling rectified spirit	[Much more soluble than in cold spirit.]	Very easily soluble ...	
Cold ether	Slightly soluble	Almost insoluble	Insoluble.

4. ARICINA.

1829,[1] Pelletier and Corriol obtained from Arica bark (see *ante*, p. 97), an alkaloid ich they gave the name of *Aricine*. They describe it as being crystalline, and bling in appearance cinchonia, from which it was distinguished by not being volale; by its solubility in ether; by its sulphate not crystallising from its aqueous on, but forming a tremulous jelly,[2] which by desiccation acquired a horny appear- by the alkaloid acquiring a green colour by the action of nitric acid; and lastly, weaker saturating power. In 1833, Pelletier[3] stated that the gelatinising pro- of the sulphate only belonged to the neutral solution, for he found that when was an excess of acid the sulphate crystallised in flattened needles; and he further ved that aricine contained one atom more oxygen than quina, its formula being $^{12}NO^{3}$.

se statements have not been confirmed by subsequent observers. Guibourt[4] res that the bark yielded him cinchonia and not aricine; and from his statement ady quoted at p. 97), it would appear that Pelletier himself subsequently doubted eculiar nature of aricine. Winckler[5] asserts that the green colouration by nitric depends on the presence of a minute portion of resin; but he admits the existence cinchona alkaloid, distinct from both quina and cinchonia, and which he calls in; and declares it to be identical with Manzini's *cinchovatin* or *cinchovine*.[6] Since scovery of quinidine, however, the whole subject requires re-examination.

ARICINE.—This name (derived from *Para* and *aricine*) has been given by Winckler[7]

Journ. de Pharmacie, t. xv. p. 565, 1829.

Leverköhn (Buchner's *Repertorium*, Bd. xxxii. S. 478, 1829; and Bd. xxxiii. S. 353, 1830), obtained from Cusco bark a substance whose sulphate possessed a gelatinising property; e declares it to be neither alkaline nor crystallisable.

Journ. de Pharmacie, t. xix. p. 101, 1833.

Hist. Nat. des Drogues, 4me édit. t. iii. p. 160, 1850.

Buchner's Repertorium, 2ter Reihe, Bd. xxv. p. 298, 1824.

Ibid. 2ter Reihe, Bd. xxxi. p. 249, 1843.

Ibid. 2ter Reihe, Bd. xlii. p. 29, 1846.

to a supposed distinct cinchona alkaloid obtained from Para bark. It closely resembles aricine, but differs from it by its greater solubility in ether, its uncrystallisability, and its greater equivalent weight. Nitric acid causes a precipitate in a solution of the sulphate of paricine. In this and some other properties paricine resembles bibirina. Winckler[1] at first considered it to be identical with Mauzin's *cinchovatine* or *cinchovine*,[2] but he subsequently discovered his error.

[Pasteur[3] states, that by keeping sulphate of quinine for three hours at a temperature of from 120° to 130°, it changes into a new base, which he calls *Quinicine*, and which is isomeric with quinine. In like manner, cinchonine, when similarly treated, forms the isomeric base *cinchonicine:* both these are precipitable from their solutions as bitter resinous liquids, very soluble in alcohol but insoluble in water. Each turns the plane of polarisation to the right, unites readily with carbonic acid, and expels ammonia from its salts. He likewise considers that two alkaloids have been confounded under the term Quinidine, one, for which he would retain the name of quinidine, which is efflorescent, isomeric with quinine, the plane of polarisation to the right; the other base, which he calls cinchonidine, is isomeric with cinchonine, turns the plane of polarisation to the left, and does not effloresce. By heat these secondary bases are changed into quinine and cinchonine respectively.—ED.]

CHEMICAL CHARACTERISTICS.—The chief constituents of the cinchona barks for which tests or reagents are applied, are, the cinchona alkaloids and principally quina. But as the therapeutical value of the barks depends, in part, on their astringency, tests are also employed to detect the cinchotannic acid. "There exists a law in Sweden," says Berzelius,[4] "in virtue of which every cinchona bark imported into the country is tested by the infusion of galls, the persulphate of iron, a solution of gelatine, and emetic tartar; and it is proved by an experience of more than sixteen years, that the most efficacious bark is that which precipitates the most strongly a solution of gelatine and emetic tartar; in other words, that which contains the most tannin." Moreover, as the bitterness of cinchona barks is not in all, if indeed it is in any, cases exclusively dependent on the alkaloids, but usually depends in part (in some of the false cinchona barks it depends exclusively) on the presence of kinovic acid, Winckler[5] recommends the testing of barks to determine the amount of this acid which they contain. Lastly, the detection of kinic acid has been proposed by Dr. Stenhouse[6] as a means of discriminating the true cinchona barks from the false ones.

1. **Tests for the Cinchona Alkaloids.**—The tests for the cinchona alkaloids which deserve especial notice are the following:—

1. *Tannic acid* is a very delicate test of the cinchona alkaloids, which it precipitates from their solutions, in the form of *tannates*. On this depends the value of *infusion or tincture of nutgalls*, employed as a test of the goodness of bark by Vauquelin,[7] by Berzelius,[8] and by O. Henry.[9] Winckler regards this as the only test applicable for the discovery of the cinchona alkaloids.

2. *Chloride of platinum.*—Duflos's quinometrical method[10] is founded on the property of the cinchona alkaloids to form with [neutral] chloride of platinum double salts

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[1] Buchner's *Repertorium*, 2ter Reihe, Bd. xli. p. 145, 1846.

[2] *Chemical Gazette*, vol. i. p. 45, 1842.

[3] *Pharm. Journ.* vol. xiii. p. 374.

[4] *Traité de Chim.* v. 587, Paris, 1831.

[5] *Jahrbuch für praktische Pharmacie*, Bd. xxv. S. 129, 1852.

[6] *Memoirs of the Chemical Society*, vol. ii. p. 226, 1845.

[7] *Ann. de Chimie*, lix. 113.

[8] *Traité de Chimie*, t. v. p. 587, Paris, 1831.

[9] *Journ. de Pharm.* xx. 429, 1834.

[10] *Pharm. Central-Blatt für* 1831, S. 537.

(*platinum-chlorides of the alkaloids*) which are insoluble in alcohol, and very difficultly soluble in cold water. One grain of these salts dried in the air contains about half a grain of the alkaloids.

3. *Production of cincholine.*—Dr. Stenhouse[1] has proposed to detect the cinchona alkaloids in a bark by the following process:—"Macerate the bark with dilute sulphuric acid, and precipitate with a slight excess of carbonate of soda or potash. Collect the dark coloured, very impure precipitate, and distil it with a great excess of caustic soda or potash: cincholin will distil over in oily drops if the bark has contained either of these vegetable alkaloids. Cincholin is easily recognisable by its peculiar taste and smell, and its strongly-marked alkaline properties. It is nearly insoluble in water, unless first neutralised by an acid, when it readily dissolves; but it is immediately precipitated in oily drops on the addition of an alkali." This test only indicates that the bark contains at least one alkaloid, the nature of which must be determined by other means; for other alkaloids (as strychnia) yield cincholin when distilled with potash.

Oxalate of Ammonia and *Sulphate of Soda* (see *ante*) have been used as tests of the alkaloid value of bark. They detect not the alkaloids, but lime; but it has been assumed (erroneously as I believe) that in proportion to the quantity of lime in bark so is that of the alkaloids. But Puttfarcken's results before referred to (see *ante*), lead to an opposite conclusion.

2. **Tests for Tannic Acid.**—These are three in number:—

1. *A solution of gelatine*, which occasions in infusion of cinchona a whitish precipitate (*cincho-tannate of gelatine*).

2. *A solution of a sesquiferruginous salt* (as persulphate of iron or sesquichloride of iron) which produces a green colour or precipitate (*cincho-tannate of the sesquioxide of iron*).

Winckler[2] says that the precipitates caused by sesquichloride of iron and isinglass solution are those formed by the *oxidised tannin*; and he adds, that the quantity of non-oxidised tannin, contained in the fluid obtained by filtration from the separated magma, may be determined by *iodic acid*, which oxidises the tannin and causes the separation of a yellowish brown pulverulent precipitate, with the evolution of the odour of iodine. The amount of the two precipitates enables us to determine the proportion of the oxidised and pure cincho-tannic acid.

3. *A solution of emetic tartar*, which causes a dirty white precipitate (*tannate of teroxide of antimony*).

3. **Tests for Kinovic Acid.**—The best test for this acid is sulphate of copper.

In an infusion of a cinchona bark devoid of kinovic acid sulphate of copper produces no appreciable effect; but when this acid is present a dark green colour is immediately produced, and very shortly a precipitate of kinovate of copper falls down, which, when collected and washed in a filter, has a bitter metallic taste. The amount of the precipitate is in proportion to the quantity of kinovic acid present.

4. **Tests for Kinic Acid.**—The readiest method of detecting this acid is that described by Dr. Stenhouse, and which consists in converting it into kinone (see *Kinic Acid*).

Winckler[3] detects kinic acid by digesting the bark (previously exhausted by rectified spirit) in cold distilled water. Filter the infusion, and concentrate by evaporation. Then mix it with binoxide of manganese and moderately strong sulphuric acid, and submit the mixture to distillation. The slightest quantity of kinic acid may be detected by the production of kinine. The presence of this may be recognised by its odour; or, if this be doubtful, by the dark colour which the distilled liquor assumes on the addition of a few drops of a solution of ammonia.

DIFFERENTIAL DIAGNOSIS.—The differential diagnosis of the cinchona barks is effected by a consideration of the external or physical characters of the bark, by microscopical examinations, and by chemical means.

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[1] *Memoirs of the Chemical Society of London*, vol. ii. p. 227, 1845.
[2] *Jahrbuch für praktische Pharmacie*, Bd. xxv. S. 129, 1852.
[3] *Ibid.* Bd. xxv. S. 136, 1852.

The external or physical characters of the more important of the genuine cinchona barks of commerce have been already described. Their examination may be greatly aided by coloured plates,[1] but chiefly by comparison with well-authenticated specimens.[2]

The microscopical examination of the barks is calculated to be more useful in comparing and distinguishing cinchona barks than is usually supposed (see *ante*, pp. 82, 83, 84, 87, 89, 93, and 96, figures 14—35.)

The chemical diagnosis of the genuine and false cinchona barks has been attempted by E. F. Anthon.[3] His most important results are embodied in the following table:—

DIFFERENTIAL CHEMICAL DIAGNOSIS OF TRUE AND FALSE CINCHONA BARK, ACCORDING TO E. F. ANTHON.

Infusion of Bark with	NH^3, turbidness and precipitate.	KI, within $\frac{1}{4}$ of an hour turbidness.	Fe^2Cl^3, within 5 or 6 minutes turbidness and precipitate.	FeO,SO^3 after 5 hours turbidness and precipitate.	1. Loxa.
				FeO,SO^3 green colour, without turbidness.	2. Huanuco.
			Fe^2Cl^3, green colour without turbidness.	FeO,SO^3 after a few minutes turbidness and precipitate.	3. Rubiginosa.
				FeO,SO^3 green colour without turbidness.	4. Rubra.
		KI, after $\frac{1}{4}$ of an hour no change.	FeO,SO^3, after 4 hours green colour without turbidness.	BaO,NO^5 immediately turbidness and precipitate.	5. Cusco.
				BaO,NO^5 no change.	6. Regia.
			FeO,SO^3, after 4 hours turbidness and precipitate.	NaO,SO^3 after a few minutes turbidness.	7. Huamalies.
				NaO,SO^3 no change.	8. Flava fibrosa.
	NH^3, brownness without turbidness; or no change.	SO^3, immediately turbidness and precipitate.	KI, immediately turbidness and precipitate.	NaO,SO^3 after $\frac{3}{4}$ of an hour turbidness and precipitate.	9. Brasiliensis.
				NaO,SO^3 no change.	10. California.
			KI, for the first hour no change.	Gelatine, turbidness.	11. Nova.
				Gelatine, no change.	12. St. Lucia.
		SO^3, no change.	CuO,SO^3, immediately turbidness and precipitate.	StCl, yellow flocculent precipitate.	13. Bicolorata.
				StCl, pale red flocculent precipitate.	14. Caribæa.
			CuO,SO^3, no change.	BaO,NO^5 turbidness and precipitate.	15. Flava dura.
				BaO,NO^5 no change.	16. Pseudo Lo.

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[1] Coloured plates of the Cinchona barks have been published by Bergen (*Versuch einer Monographie d. China*, 1826), by Goebel (*Pharm. Waarenkunde*, 1827–29), and by Weddell (*Hist. Naturelle des Quinquinas*, 1849).

[2] An excellent collection, partly formed by myself, and including the specimens exhibited by Messrs. Howards and Kent at the Great Exhibition in 1851, is contained in the museum of the Pharmaceutical Society, in Bloomsbury Square, London.—Pavon's collection of Peruvian barks, in the British Museum, is the largest *original* collection in England. It has been ably described by Mr. J. E. Howard (*Pharmaceutical Journal*, vols. xi. and xii. 1852).

[3] Buchner's *Repertorium*, 2te Reihe, Bd. iv. p. 43, 1835; and Bd. vi. p. 29, 1836.

The infusion of bark used in these experiments was prepared by pouring 4 parts of boiling distilled water over one part of bark cut in very small pieces. After 12 hours, digestion the liquid was filtered and the tests immediately applied. If the infusion be kept for some time before it is tested discordant results may be obtained.

The following were the tests employed:—

NH^3. Pure liquor ammoniæ, sp. gr. 0·990.
KI. One part of iodide of potassium dissolved in 6 parts of water.
SO^3. Pure diluted sulphuric acid, sp. gr. 1·090.
F^2Cl^3. One part of pure sublimed chloride of iron dissolved in 8 parts of water.
FeO,SO^3. One part of newly made sulphate of the protoxide of iron dissolved in 6 parts of water.
CuO,SO^3. One part of pure sulphate of copper dissolved in 12 parts of water.
BaO,NO^5. A saturated aqueous solution of nitrate of baryta.
NaO,SO^3. One part of pure sulphate of soda dissolved in 6 parts of water.
Gelatine. One part of gelatine (*weisser Leim*) dissolved in 12 parts of water.
StCl. One part of newly made muriate of the protoxide of tin dissolved in 8 parts of water.

QUANTITATIVE DETERMINATION OF THE CINCHONA ALKALOIDS.

Quinometry.—Various alcaloimetrical processes, applicable to the cinchona barks, have been recommended. They are essentially of two kinds: some consist in the use of certain reagents or tests, already described, others are processes for the extraction of the alkaloids, which are obtained either in the free state or as salts (usually as sulphates).

The *Edinburgh Pharmacopœia* gives the following directions for ascertaining the good quality of yellow bark:—

"A filtered decoction of 100 grains in two fluid ounces of distilled water gives, with a fluid ounce of concentrated solution of carbonate of soda, a precipitate, which, when heated in the fluid, becomes a fused mass, weighing when cold 2 grains or more, and easily soluble in solution of oxalic acid." In this process the native salts of the alkaloids extracted by the boiling water are decomposed by carbonate of soda. By heat the alkaloids fuse.

This process, however, is quite insufficient for the purposes of commerce. In commerce the value of a cinchona bark mainly depends on the quantity of crystallisable sulphate of quina which it is capable of yielding; and it is not, therefore, sufficient to determine the amount of quina which it yields, because the whole of this may not be convertible into crystallisable sulphate.

Some manufacturers subject their barks to the operation, hereafter to be described, for the manufacture of the crystallised sulphate of quina. The quantity operated on should never be less than a pound of bark; and even then the product is always smaller (to the extent of at least from $\frac{1}{8}$ to $\frac{1}{4}$) than can be obtained in operations on a large scale, where the loss is proportionately smaller.

Wöhler's cinchona bark test[1] is thus applied:—Take half an ounce of the powdered bark, a sufficient quantity of water, and a scruple of hydrochloric acid. Boil, filter the decoction, and wash the residue with water. Evaporate the decoction to dryness, redissolve the extract in water acidulated with a few drops of hydrochloric acid: the cinchona red remains undissolved. Precipitate the alkaloids from the solution by ammonia, and collect, dry, and weigh the precipitate. The alkaloids are separated from each other by ether, which dissolves quina and quinadina, but leaves the cinchona.

Buchner's cinchona bark test[2] is thus employed:—Take one ounce of cinchona bark in powder, twelve ounces of water, and dilute sulphuric acid half a scruple. Boil for half an hour. Wash the residual powder with four ounces of hot water. Filter the decoction and immediately add to it ammonia or carbonate of soda. Wash the precipitate with a little cold water, press it between folds of blotting paper, dry it in a water-bath, and then weigh it. The whole operation may be performed within one and a half or two hours. (The alkaloids comprising the precipitate may be separated from each other by ether.)

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[1] *Pharmaceutical Journal*, vol. xi. p. 164, 1851.
[2] *Ibid.*

The following is *Rabourdin's cinchona bark test*[1] as applied for yellow bark:—Take five drachms of bark powdered and passed through a fine horse-hair sieve; exhaust it with water acidulated with hydrochloric acid (2 parts by weight of acid to 100 parts of water) in a displacement apparatus. The percolation of the liquid is to be stopped when it passes through colourless and insipid. We thus obtain about five or six ounces of liquid, to which about a drachm and a half of caustic potash and two and a half drachms of chloroform are to be added. Agitate them for a short time, and then set them aside. A whitish, very dense deposit, composed of quina, cinchonia, and chloroform, is formed. Sometimes the separation is completely effected in an instant, leaving a red transparent supernatant liquid which may be immediately decanted, and the chloroformic solution, washed, collected in a small capsule, and allowed to evaporate spontaneously, leaving the alkaloids in a pure state.

Winckler's cinchona bark test is as follows:—Exhaust the powdered bark by rectified spirit, sp. gr. 0·840. Decolorise the tincture by a mixture of equal parts of slacked lime and animal charcoal, and then distil off the greater part of the spirit in a water-bath. The residue contains the alkaloids in combination with kinovic acid (when this acid is a constituent of the bark), and a peculiar fatty matter. Frequently there is also present a small quantity of oxidised tannin, which is mechanically mixed with the other ingredients. To purify the alkaloids dissolve them in water acidulated with sulphuric acid, and filter the solution: by this means we get rid of the kinovic acid and fatty matter. Add to the filtered liquor a slight excess of ammonia, and evaporate the mixture to dryness; and then extract the sulphate of ammonia by means of a little cold water. The residual alkaloids are afterwards to be dried and weighed; as any further purification of them is attended with too great a loss to be practised. The quina and cinchonia are to be separated from each other by means of ether.

The separation of the cinchona-alkaloids from each other is usually effected by means of ether, which dissolves quina and quinidina, but leaves cinchonia. Quinidina is separated from quina by its crystallisation from its ethereal solution; quina not being crystallisable.

Pelletier and Caventou[2] separated quina and cinchonia by means of boiling alcohol: as the solution cools the cinchonia crystallises, leaving the quina in solution. Winckler employed rectified spirit to separate quinidina from quina: the former alkaloid crystallises from the alcoholic solution.

The different solubilities of the sulphates of the three alkaloids in water may also be employed to separate them: the sulphate of quina is the first to deposit as the solution cools, leaving the sulphate of cinchonia in solution. Sulphate of quinidina has an intermediate solubility.

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[1] *Journ. de Pharmacie et de Chemie*, 3me sér. t. xix. p. 11, 1851; and *Pharmaceutical Journal*, vol. x. p. 470, 1851.

[2] *Journ. de Pharmacie*, t. vii. p. 305.

[3] *Chemical Gazette*, vol. vi. p. 164, 1848.

E SHOWING THE QUANTITY OF ALKALOIDS OBTAINED FROM CINCHONA BARKS, ACCORDING TO RECENT AUTHORITIES.

0 parts of Bark.	Quina.	Quinidine.	Cinchonia.	Total Alkaloids.	Authority.	Observations.
YA OR YELLOW BARK.						
	38·0	[+]	[+]	?	Riegel.	According to Pelouze, 1000 parts of Calisaya bark yield from 30 to 40 parts of sulphate of quina. An ounce of commercial sulphate of quina is obtained from 1¾ lbs. to 2¼ lbs. avoird. of bark.
ort.	25·0	[+]	[+]	?	Riegel.	
ephina	32·9	[+]	[+]	?	Riegel.	
ABAYA BARK.						
al (see *ante*)	+	+	+	30 to 40	J. E. Howard	Used in the fabrication of sulphate of quina.
RED BARK.						
	26·5	[+]	15·1	41·6	Riegel.	According to Pelouse, 1000 parts of bright red bark yield from 15 to 16 parts of sulphate of quina, and from 8 to 9 parts of sulphate of cinchonia. The produce of the paler sort is less.
pieces	[+]	[+]	[+]	38·5	Riegel.	
LOXA BARK.						
d sort in bundles	7·14	5·14	0·40	12·68	J. E. Howard	According to Pelouze, 1000 parts of grey Loxa bark yield from 10 to 12 parts of sulphate of cinchonia.
wn, 1850	0	5·7	0·6	6·3	J. E. Howard	
wn, 1851	0	10·5	0·8	11·3	J. E. Howard	
wn	5·0		9·14	14·14	J. E. Howard	
wn mixed with corky	4·0		2·85	6·85	J. E. Howard	
ied finest Crown	5·2	..	4·2	9·4	Riegel.	
OF HUANUCO BARK.						
(*Cinchona nitida?*)	5·71	1·42	14·0	21·13	J. E. Howard	Fine grey and inferior grey are frequently imported intermixed. Pelouze states that 1000 parts of grey Lima bark yield 11 to 12 parts of sulphate of cinchonia.
coarse grey (*Cinchona* *a?*)	2·43	2·80	12·5	17:73	J. E. Howard	
dium quills	..	..	24·0	..	Riegel.	
ls	..	..	18·7	..	Riegel.	
ASH BARK.						
	0	12	16	28	J. E. Howard	
ing specimen	0	6 1	8·6	14·7	J. E. Howard	
ES OF RUSTY BARK.						
ted sort	0	2·57	7·4	9·97	J. E. Howard	It is tolerably obvious that verydifferent barks have been included under the designation of Huamalies bark.
ills and arched flat	3	..	8·6	11·6	Winckler.	
medium quills and	..	..	14·6	..	Riegel.	
rty quills and flat	..	..	9·3	..	Riegel.	
CONDAMINEA BARK.						
Commerce	+	+	+	..	J. E. Howard	Used in the fabrication of sulphate of quina. 1000 parts, according to Guibourt, yield 11·52 of sulphate of quina.
Pitaya	..	+	23	..	Guibourt.	
THAGENA BARKS.						The fibrous Carthagena or Coquetta bark is used by sulphate of quina manufacturers, but the produce is exceedingly variable. From the three samples analysed by Mr. Hindsley, he obtained respectively 10·3, 4·6, and 8·2 parts of sulphate of quina from 1000 parts of bark. An ounce of sulphate of quina is obtained from 4 to 6 lbs. of bark.
sort (*C. cordifolia.*)						
dura	10·4	..	13·5	23·9	Riegel.	
s sort (*C. lancifolia.*)						
fibrosa	10·4	..	10·4	20·8	Riegel.	
ark	+	1·5	4·4	..	Hindsley.	
lancifolia bark	+	2·5	3·5	..	Hindsley.	
uill	+	2·3	12·6	..	Hindsley.	

SIOLOGICAL EFFECTS.—Before I proceed to describe the effects of a barks it appears to me desirable to notice the separate effects e principles on whose combined operation the activity of the bark s.

I. *Effects of the Active Principles of Cinchona Bark.*

The essential or tonic and antiperiodic or specific effects of the bark reside in the cinchona alkaloids; but these are aided by some of the other constituents. The astringent and aromatic qualities of the bark reside in other principles.

1. *Effects of Cincho-tannic Acid.*—Like other varieties of tannic acid this acid possesses astringent qualities, and promotes the tonic operation of the alkaloids. It is remarkable, in a chemical point of view, for the facility with which it suffers oxidation; and it is probable, therefore, that in its passage through the system it more readily undergoes oxidation than most other forms of tannic acid.

2. *Effects of Kinovic Acid.*—As this is a bitter principle it might be expected to possess tonic and possibly febrifuge properties. Dr. Weil,[1] however, declares that it is not a febrifuge; for it failed to relieve a case of tertian fever which was afterwards readily cured by sulphate of quina. This is all that is known of its physiological and therapeutical powers.

3. *Effects of Kinic Acid.*—Nothing positive is known of the effects of kinic acid or the kinates. Kinate of lime, which Deschamps erroneously fancied to be the active principle of cinchona bark, is probably inert. It has neither bitterness nor stypticity.

4. *Effects of Cinchona-red* or *Red Cinchonia.*—May perhaps slightly contribute to the astringent and tonic effects of the barks.

5. *Effects of the Volatile Oil and Resin.*—The aromatic flavour depends on these principles.

6. *Effects of the Cinchona Alkaloids.*—Quina, cinchonia, and quinidina, are the only alkaloids with whose operation we are acquainted.

I. **Effects of Quina.** α. *On Vegetables.*—According to Goeppert, the leaves of plants plunged in a solution of sulphate of quina (gr. ss. of the salt to ℥ss. of water) presented evidences of contraction in six or eight hours.[2]

β. *On Animals generally.*—As soon as Pelletier had discovered the alkaloids in bark, he sent some of them to Magendie for trial, who ascertained that neither in the pure nor saline state were they poisonous; and he found that ten grains of the sulphate or acetate of these bases might be injected into the veins of a dog without any ill effect.[3] Hartl[4] found that three grains of quina applied to a wound in a rabbit occasioned no ill effects.

Later observations, however, have shown that in certain doses sulphate of quinine proves fatal to animals. Melier[5] found that it occasioned stupor, staggering, or sudden falling down, dilatations of the pupil, coma, convulsions, and in all cases increased frequency of pulse. The *post-mortem* appearances were congestion of the lungs and deficient coagulability of the blood.

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[1] Buchner's *Repertorium*, 2te Reihe, Bd. iii. p. 396, 1835.

[2] De Candolle, *Phys. Vég.* 1349.

[3] *Journ. de Pharm.* vii. 138.

[4] *Wirk. d. Arzneim. u. Gifte*, Bd. ii. S. 133.

[5] *Exper. et. obs. sur les propriétés toxiques du sulfate de quinine* (*Mém. de l'Acad. Royale de Méd.* t. x. p. 722, 1843).

γ. *On Man.*—In *small doses* quina occasions an intensely bitter taste, promotes the appetite, and assists digestion. It possesses in a pre-eminent degree the properties of a pure or simple bitter.

In *large doses* (as ten to twenty or more grains), disulphate of quina has produced three classes of effects:—

1. *Gastro-enteritic irritation*, marked by pain and heat in the gastric region, nausea, gripings, and purging. Occasionally ptyalism has been observed. Constipation sometimes follows its use.

2. *Excitement of the vascular system*, manifested by increased frequency and fulness of pulse and augmented respiration. Furred tongue, and other symptoms of a febrile state, are also observed.

[M. Briquet[1] considers that sulphate of quinine in a full dose diminishes the force and frequency of the pulse; that, while it influences the composition of the blood, increasing (in animals) the proportion of the fibrine and the water, it diminishes the blood globules and the albumen.—ED.]

3. *Disorder of the cerebro-spinal functions*, indicated by headache, giddiness, contracted, in some cases dilated, pupils, disorder of the external senses, agitation, difficulty of performing various voluntary acts (as writing), somnolency, in some cases delirium, in others stupor.

A remarkable case is mentioned by Trousseau and Pidoux.[2] A soldier took forty-eight grains of sulphate of quina for the cure of an asthma [spasmodic], which returned daily at a certain hour. Four hours after taking it he experienced buzzing in the ears, diminished sensibility, giddiness, and violent vomitings. Seven hours after taking the quina he was blind and deaf, delirious, incapable of walking on account of the giddiness, and vomited bile copiously. In fact, he was in a state of intoxication. These effects subsided in the course of the night.

On man, as in the lower animals, sulphate of quina has produced fatal effects. Recamier,[3] at the Hôtel-Dieu, prescribed for a patient affected with acute rheumatism three grammes [=46 grs. Troy] of the sulphate in twelve powders, one to be taken every hour. The next day the quantity was increased to five grammes [=77 grs. Troy] to be taken every hour as before. When the patient had taken three and a half grammes [=53 grs. Troy] he was suddenly seized with violent agitation, followed by furious delirium and death in a few hours.

Dangerous consequences have been reported by other writers.[4] But in many cases no ill effects have resulted from the use of large doses. Thus Bally has given 110 grains daily without any inconvenience. From these and other cases sulphate of quina has been denominated a *narcotic*. In some instances it has appeared to act as a *stimulant*, in others as a *sedative*.[5]

I have already mentioned Piorry's observation that quina diminishes the volume of the spleen, and in this way cures ague.

Sulphate of quina, when taken into the stomach, becomes absorbed into the blood, and is eliminated by the urine, the sweat, and the milk.[6]

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[1] *Annuaire de Thérapeutique*, p. 150, 1854.

[2] *Traité de Thérap.* ii. 217.

[3] Bouchardat, *Annuaire de Thérap.* pour 1843, p. 170.

[4] *Ibid.* pp. 172 and 173.

[5] Dunglison, *New Remedies*, 6th edit. p. 618, 1851.

[6] See also Herapath's observations, *Pharm. Journal*, Nov. 1853, p. 216. Landerer, Buchner's *Repert.* 2te Reihe, Bd. v. p. 231; also Quévenne, Piorry, Lavallée, Melier, &c. quoted by Mérat (*Suppl. au Dict. de Mat. Méd.* p. 602, 1846).

[Dr. W. B. Herapath states that he has found quina in the urine, under the following circumstances. A man, suffering from tetanus, took five grains of disulphate of quina, with half a grain of *Cocculus Indicus*, every three hours: he consequently took forty grains of the disulphate in the period of twenty-four hours. The urine had a greenish-yellow colour, and upon standing deposited a brownish-yellow sediment. It was slightly acid, and had a specific gravity of 1·032. The sediment examined by the microscope showed prisms and lozenges of uric acid, with amorphous urate of ammonia. The fluid urine was decanted, rendered alkaline with potash, and then repeatedly agitated with pure washed ether. On evaporation this left about 1·4 grains of alkaloid, obtained from about eight ounces of urine. By the addition of acetic acid, and subsequently a drop of the alcoholic solution of iodine, Dr. Herapath was enabled, by the aid of a polarising microscope, to identify the crystals of quina. This gentleman remarks, in reference to the elimination of the alkaloid, that while, by calculation, his results gave only eleven grains, there was a deficiency of thirty grains to be accounted for; and this, he says, must have either been assimilated in the body, or have been destroyed in its transit through the vascular system.[1] This observation is of importance in reference to recent statements, that alkaloids are neither assimilated nor destroyed in their passage through the body, but pass through it unchanged in nature and quantity.—ED.] Merat even states that after the use of it he has observed in his own person that the expectorated mucus smells of cinchona!

II. **Effects of Quinidina.**—But few observations have hitherto been made on the effects of this alkaloid. From the similarity of its chemical properties to those of quina, it has been inferred, and, as I believe, correctly, that it resembles the latter alkaloid in its medicinal qualities. Bauduin[2] declares it to be as effective a febrifuge as quina. I have for some months past used at the London Hospital the sulphate of quinidina as a substitute for sulphate of quina, and have found it equally serviceable both as a tonic and febrifuge. Several cases of ague in the Hospital have got entirely well under its use. I have administered it in varying doses not exceeding ten grains.

III. **Effects of Cinchonia.**—If we take into consideration the similarity of chemical properties of cinchonia and quina, we are led to suspect analogy of physiological effects. When they were in the first instance submitted to examination, cinchona and its salts were thought, principally on the evidence of Chomel, to be much inferior in activity to quina and its salts. But the subsequent observations of Dufour, Petroz, Pottier, Bally, Nieuwenhuiss, Mariani, Bleynie, and others, have appeared to prove that the sulphates of these alkaloids may be substituted for each other. Nay, Bally gives the preference to the sulphate of cinchonia, on the ground that it is less irritating than the sulphate of quina. That cinchonia is as active as quina might have been anticipated, *à priori*, when we recollect that those barks in which cinchonia is the predominant principle were the first which were celebrated as therapeutic agents.

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[1] *Pharmaceutical Journal*, 1853, vol. xiii. p. 216.

[2] Quoted by Van Heijningen, in the *Pharmaceutical Journal*, vol. ix. p. 327, 1850.

As cinchona and its salts are less bitter than quina and its salts, we might expect that the former would possess somewhat less medicinal activity than the latter; and this inference is probably correct. Moreover, as cinchonia and its salts have a more nauseous flavour, and are more allied to that of sulphate of magnesia, it might naturally be anticipated that large doses of sulphate of cinchonia would be more apt to create nausea and vomiting than like doses of sulphate of quina; and I have been informed by some medical friends that this is in reality the case. I must confess, however, that I have been unable to verify it. I have extensively used in hospital practice sulphate of cinchonia, in doses not exceeding ten grains, and have not met with the nausea and vomiting I expected to have met with. In a case of ague I ordered the patient (a young man) to take ten-grain doses of the sulphates of quina, quinidina, and cinchonia on separate successive days every two hours before dinner; that is, the sulphate of quina on one day, the sulphate of quinidina on the second, and the sulphate of cinchonia on the third day. The case was very carefully watched by one of my clinical clerks, but no difference of effect was discernible. No sickness or vomiting took place. I have found the sulphate of cinchonia valuable both as a tonic and a febrifuge, or antiperiodic. [MM. Bouchardat, Delondre, and Gerault have made numerous experiments, comparing the effects of cinchonia with quina, from which they conclude that the former kills fish, worms, and slugs, as rapidly as the latter, and that it is even more energetic in its action on frogs. From their experiments on dogs it appears, 1st. that cinchonia in full dose lowers the action of the heart, as shown by the diminution of the pressure in a hæmadynameter, but that this diminution is less than that which would have been produced by an equal dose of quina, and it requires a larger dose of cinchonia to destroy these animals than it does of quina.[1] They further assert, that though the action of cinchonia on a healthy man presents considerable resemblance to that of quina, still there exist differences which are not merely in degree. Thus, the sulphate of cinchonia does not cause noises in the ears and disturbances of vision, so readily as sulphate of quina, but in smaller doses, and more frequently than the latter, it causes a severe headache, which affects the forehead in particular, and is accompanied by a remarkable feeling of compression. These symptoms are observed after a dose of from 9¼ to 15½ grs.; which quantity of cinchonia is followed by præcordial pain, and a very evident debility (which may even bring on syncope) more often, and to a greater degree, than would occur after a similar dose of quina.[2]

Sulphate of cinchonine appears to be equal to sulphate of quinine in the treatment of the milder cases of intermittent fever when time is not all important, and there is no reason to dread a severe attack; but in the more severe cases the sulphate of quinine ought to be preferred.—ED.]

Comparison of the Cinchona Alkaloids with their salts.—Some of the salts of the cinchona alkaloids being more soluble than their bases, it has been inferred that they are, consequently, more active. But it has been asserted by Nieuwenhuiss, Mariani, Bleynie, and others, that the bases are equally active, and may be substituted for the salts with advantage.[1] Acid drinks should be given to favour their solution in the stomach. Quina, in the crude or impure state, has been employed with success by Trousseau.[2] Its advantages over the disulphate are, that it is less apt to purge; it may be exhibited in a smaller dose, and it loses but little bitterness. This last property facilitates the use of it, especially in children.

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[1] *Supplément à l'Annuaire de Thérapeutique*, 1856, p. 24.
[2] *Ibid.* 1854, p. 154.

Comparison of the salts of the cinchona alkaloids with each other.—I have already described the effects of the *sulphate of quina.* The *bisulphate of quina* is formed when we dissolve the sulphate in water, acidulated with sulphuric acid: it is somewhat more irritant than the last-mentioned salt. The *phosphate of quina* is said to be not so apt to disturb the stomach, or to excite the vascular system, as the sulphate. Hence it is better adapted for cases accompanied with gastric irritation and febrile disorder. The *ferrocyanate of quina* has been recommended, in preference to the sulphate, in intermittent fevers, accompanied with inflammatory symptoms. The *tannate of quina* has been declared, by Dr. Rolander, of Stockholm, to be the most powerful of the quina salts. The tannic acid, though not the peculiar febrifuge constituent of cinchona bark, yet contributes to its tonic powers, and thereby promotes the activity of the alkaloids. This statement is supported by the already referred to remark of Berzelius that the most active cinchonas are those which contain the largest quantity of tannin. Recent observations have not, however, confirmed Rolander's statement. The *nitrate, hydrochlorate, acetate,* and *citrate of quina,* have been employed in medicine; but I am not acquainted with any remarkable advantages they possess over the sulphate. The *kinate of quina,* as being one of the native salts of the alkaloid, deserves further examination. The *arsenite of quina* might, perhaps, be found available in some obstinate intermittents, and well deserves further examination. The *valerianate of quina* has been already noticed. The *disulphate of quinidina* is the only salt of quinidina whose effects have been examined. [Dr. Peacock has administered the disulphate of quinidina as an antiperiodic, in doses of three to six grains, with perfect success. In some cases a dose of fifteen grains was given at first. Dr. P. considers quinidina as efficacious as quina, while it possesses the advantage of not giving rise to the disagreeable nervous effects occasionally observed when quina is administered in large doses.[3]—ED.] The *salts of cinchonia,* except the disulphate, have been imperfectly examined.[4]

[*Effects of cinchonicine.*—M. Forget[5] has administered cinchonicine (not cinchonine) in cases of fever, but he finds, that though it occasionally cures them, its efficacy cannot be compared to that of sulphate of quina. He has also administered it with good results in a single case of acute rheumatism.—ED.]

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[1] *Dict. de Mat. Méd.* t. v. p. 596.

[2] Soubeiran, *Traité de Pharm.* i. 604.

[3] *Med. Times and Gazette,* Nov. 1st, 1856.

[4] For further details respecting the effects of the salts of quina, consult Mérat and De Lens, *Dict. de Mat. Méd.* t. v. 597, and Mérat, *Suppl. au Dict. de Mat. Méd.* p. 600, 1846; Dierbach, *Neuest. Entd. d. Mat. Med.* Bd. i. S. 237, 1837, and Bd. ii. S. 366, 2te Aufl.; and Dunglison, *New Remedies,* 6th edit. 1851.

[5] *Annuaire de Thérapeutique,* p. 176, 1855.

II. *Effects of the Cinchona Barks.*

The experiments of Dr. Adair Crawford[1] on the effects of tonics in promoting the cohesion of the animal tissues, have been already referred to. He found that a kitten's intestines, which had been immersed in a thick mixture of cinchona bark and water, required a greater weight to break them than those immersed in water merely, in the ratio of 25·5 to 20·7. He found, moreover, that the same effect was produced on the blood-vessels and nerves; but an opposite effect on the skin, the cohesion of which it diminished in the ratio of 24·5 to 7·9. Hence he inferred that cinchona bark strengthened the alimentary canal, blood-vessels, and nerves, but had a debilitating or relaxing effect on the skin.[2] The error pervading these inferences has been already pointed out. Admitting that the dead animal tissues are invariably affected by cinchona in the way Dr. Crawford states, the conclusion that living tissues would be influenced in the same way is not supported by facts. Cold water relaxes dead, but corrugates living, animal tissues.

α. *On Vegetables.*—Leaves of plants immersed in an infusion of pale bark were dried, but not contracted, in twenty-four hours.[3]

β. *On Animals generally.*—Dr. Friend[4] states that an ounce and a half of a strong decoction of bark, injected into the jugular vein of a dog, caused, in fifteen minutes, strong palpitations of the heart, and frequent spasms. Half an ounce more being injected, brought on tetanus and death. The blood was found after death liquid, the lungs red and turgid; the right ventricle was distended with blood, the left contained scarcely any. Rauschenbusch[5] has also made experiments with cinchona bark. In animals to whom he had given it for some days, he found the stomach and alimentary canal contracted, and the coats thickened, but no traces of inflammation. The heart was firmer, the lungs covered with red spots, the liver yellowish, the bile watery and greenish. When the blood was exposed to the air, it remained dark-coloured for a longer time than usual, was less coagulable, and the serum separated more slowly: it appeared like that drawn in inflammatory cases. The pulse was stronger and fuller, the animal heat increased, and, when the bark had been used for a long period, the muscles were pale, and their energy enfeebled. Some experiments on the effect of cinchona on the blood-discs of frogs were made by Leeuwenhoek,[6] who found that the infusion of bark divided some of the discs, and coagulated others.

γ. *On Man.*—The *topical effects* are astringent and slightly irritant.

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[1] *Experimental Inquiry into the Effects of Tonics*, 1816.

[2] It is obvious that the tannic acid contained in cinchona bark would exercise a local chemical influence on the tissue, combining with both the albuminous and gelatinous tissues.

[3] De Candolle, *Phys. Vég.* 1349.

[4] *Emmenol.* c. xiv.

[5] Quoted by Wibmer, *Wirk. d. Arzneim u. Gifte*, Bd. ii. 132.

[6] *Contin. ad. Epist.* p. 119.

The astringency depends on tannic acid [and red cinchonic?]: hence those barks whose infusions are most powerfully affected by gelatine and the sesqui-ferruginous salts possess the greatest astringent power. The *constitutional effects* are principally manifested by the disordered conditions of the vascular and cerebro-spinal systems. In some conditions of system cinchona operates as an *irritant* or *stimulant;* in others as a *stomachic, tonic,* and *corroborant.*

If a man in a state of perfect health take a small or moderate dose of bark, no obvious effects are produced,— or perhaps a little thirst, with some slight disorder of stomach; or a temporary excitement of appetite may be brought on. If the dose be increased, the alimentary canal becomes disordered (indicated by the nausea, vomiting, loss of appetite, thirst, and constipation, or even purging); a febrile state of the system is set up (manifested by the excitement of the vascular system, and dry tongue); and the cerebro-spinal system becomes disordered, as is shown by the throbbing headache and giddiness. The disturbance of the functions of the stomach is produced not only when the bark is given in the more nauseating form of powder, but also in the form of infusion, or decoction, or tincture. These symptoms indicate a stimulant operation, which is still more manifest when the bark is given to a person suffering with gastro-enteritic irritation, accompanied with fever. All the morbid phenomena are exasperated, the febrile disorder is increased, and symptoms of gastritis come on. None of the effects now enumerated include those to which the term *tonic* is properly applicable. These are to be sought for in patients suffering from debility, without symptoms of local irritation. In such we find cinchona improves the appetite, promotes the digestive functions, and increases the strength of the pulse. The muscular system acquires more power, and the individual is capable of making greater exertion, both mental and bodily, than before; the tissues acquire more firmness to the touch, and lose their previous flabbiness: moreover, it has been asserted (and with great probability of truth) that the quality of the blood improves.

The real *stomachic, tonic,* and *corroborative* effects of cinchona, as indeed of other agents of the same class, are then only observed in certain morbid conditions.

"The general operation of cinchona bark," observes Sundelin,[1] "consists in the *increase and exaltation of the tone of the irritable fibres and of the fibres of the vessels* (hence by its use the pulse becomes fuller, stronger, and regular, and the muscular power increased); also in the *general augmentation of the cohesion of the organic mass* (hence it counteracts a tendency to liquefaction [*Verflüssigung*] and disintegration [*Entmischung*], diminishes profuse secretions which proceed from atony of the extremities of the vessels and of the secerning surfaces and organs, and improves generally the crasis); and lastly, in the *augmentation of the vital energy of the sensible system.* (By the last-mentioned property it restores sensibility, when defective or abnormally increased, and the property of reaction of the nervous system, to their normal state, and augments the influence of this system on the muscular fibre and on the reproductive system.)" As these effects are not produced until the active constituents of the bark have been absorbed, they take place gradually, and by the long-continued use of this agent.

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[1] *Handbuch d. speciellen Heilmittellehre,* Bd. ii. S. 307, 3tte Aufl. 1833.

The power possessed by cinchona of suspending or completely stopping periodical diseases, deserves to be noticed here, though it will have to be again referred to hereafter. It is doubtless in some way related to the before-mentioned effects; but the connection is, as yet, mysterious and incomprehensible.

Comparison of the cinchona barks with each other.—Those barks are the most active which contain the largest proportion of the cinchona alkaloids, especially of quina. In this point of view *yellow* or *Calisaya bark* stands pre-eminent; and Dr. Relph's[1] assertion of its superiority to both the red and the pale barks is fully borne out by modern observations. *Red bark* is also a very valuable sort. The experiments and observations of Saunders,[2] Rigby,[3] Kentish,[4] Irving,[5] and Skeete,[6] seem to have established its superiority to the pale or quilled kind. But in adopting this statement we ought, if possible, to ascertain what kind of pale bark was used in making the above observations; and also to determine whether the red bark referred to be identical with that now in commerce. Mr. J. E. Howard (see *ante*, p. 103) has shown that the *original or old Loxa bark*, the sort probably which was originally employed under the name of pale or Crown bark, is as rich in cinchona alkaloids as many specimens of Calisaya bark.

The *H. O. Crown bark* and *ashy Crown bark* are, especially the last-mentioned bark, greatly inferior to the old Loxa bark: yet they are the barks usually found in the shops under the name of *pale* or *quilled bark*. *Fine grey bark* is a bark of excellent quality. *Pitaya-Condaminea bark* is but little known in commerce; but it is a bark rich in cinchona alkaloids.

Comparison of the effects of the cinchona barks with their alkaloids.—It has been asserted, that the cinchona alkaloids possess all the medicinal properties of the barks, and may be substituted for them on every occasion; but I cannot subscribe to either of these statements; for, in the first place, the alkaloids are deficient in the aromatic quality possessed by the barks, and which assists them to sit easily on the stomach; and it is to this circumstance that I am disposed to refer a fact which I have often observed, that sulphate of quina will sometimes irritate the stomach, occasion nausea and pain, and give rise to febrile symptoms, while the infusion of bark is retained without the least uneasiness. Moreover, we must not overlook the tannic acid, which confers on bark an astringent property. So that while we admit that the essential tonic operation of the barks depends on the alkaloids which they contain, yet the latter are not always equally efficacious. In some cases, however, they are of great advantage, since they enable us to obtain, in a small volume, the tonic operation of a large quantity of bark.

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[1] *Inquiry into the Medical Efficacy of Yellow Bark*, 1794.

[2] *Observations on the Superior Efficacy of Red Peruvian Bark*, 1782.

[3] *Essay on the Use of Red Peruvian Bark*, 1783.

[4] *Experiments and Observations on a New Species of Bark*, 1784.

[5] *Experiments on Red and Quilled Peruvian Bark*, 1785.

[6] *Experiments and Observations on Quilled and Peruvian Bark*, 1786.

USES.—From the preceding account of the physiological effects of cinchona, some of the indications and contra-indications for its use may be readily inferred. Thus its topical employment is obviously indicated in cases of local relaxation, with or without excessive secretion; also in poisoning by those agents whose compounds with tannic acid are difficultly soluble, and, therefore, not readily absorbed. But as a topical remedy, or astringent, cinchona is greatly inferior to many other agents which contain a much larger quantity of tannic acid. The contra-indications for the local use of cinchona, are, states of irritation (nervous or vascular), and of inflammation. In these conditions it aggravates the morbid symptoms.

The indications for its use, as a general or constitutional remedy, are, debility with atony and laxity of the solids, and profuse discharges from the secreting organs. I have observed that it proves less successful, and often quite fails, when the complexion is chlorotic or anæmic: in such cases chalybeates often succeed where cinchonia is useless or injurious. As contra-indications for its employment, may be enumerated acute inflammation, inflammatory fever, plethora, active hæmorrhages, inflammatory dropsies, &c. To these may be added, an extremely debilitated condition of the digestive and assimilative organs. Thus, patients recovering from protracted fever are at first unable to support the use of bark, which acts as an irritant to the stomach, and causes an increase of the febrile symptoms. In such cases I have found infusion of calumba a good preparative for cinchona.

Hitherto I have referred to those indications only which have an obvious relation to the known physiological effects of cinchona. But the diseases in which this remedy manifests the greatest therapeutic power, are those which assume an intermittent or periodical type. Now in such the *methodus medendi* is quite inexplicable; and, therefore, the remedy has been called a *specific*, an *antiperiodic*, and a *febrifuge*. But the more intimately we become acquainted with the pathology of disease, and the operation of medicines, the less evidence have we of the specific influence of particular medicines over particular maladies. Some diseases, however, are exceedingly obscure; their seat or nature, and the condition of system under which they occur, or the cause of their occurrence, being little known. There are also many medicines, the precise action of which is imperfectly understood, but which evidently exercise a most important, though to us quite inexplicable, influence over the system. Now it sometimes happens that imperfectly-known diseases are most remarkably influenced by remedies the agency of which we cannot comprehend: in other words, we can trace no known relation between the physiological effects of the remedy, and its therapeutical influence. This incomprehensible relationship exists between arsenic and lepra; between the cinchona bark and ague. But though this connection is to us mysterious (for I do not admit the various hypotheses which have been formed to account for it), we are not to conclude that it is necessarily more intimate than that which exists in ordinary cases.

1. *In periodical or intermittent diseases.*—The system is subject to several diseases, which assume a *periodical* form; that is, they disappear and return at regular intervals. When the patient appears to be quite well during the interval (*i. e.* when the intermission is perfect and regular) the disease is called an *intermittent;* whereas it is called *remittent* when the second paroxysm makes its appearance before the first has wholly subsided (*i. e.* when the disease presents exacerbations and remissions, but not intermissions). The pathology of these affections is involved in great obscurity, and the cause or causes of their periodicity are completely unknown. Various circumstances, however, induce us to regard intermittent maladies as morbid affections of the nervous system; for the phenomena of periodicity, both healthy and morbid, seem to be essentially nervous.[1] One of the most curious circumstances connected with the history of these diseases is the facility with which they are sometimes cured. It is well known that sudden and powerful impressions, both mental and corporeal (as those caused by terror, alcohol, opium, cinchona, arsenious acid, &c.), made during the intermission, will sometimes prevent the return of the succeeding paroxysm; and occasionally from that time all morbid phenomena disappear. In remittent diseases, on the other hand, the same impressions are much less frequently successful, and sometimes, instead of palliating, exasperate the symptoms. The agents which are capable, under certain circumstances, of making these curative impressions, are apparently so dissimilar in their nature and physiological action, that we can trace in their *methodus medendi* scarcely any thing in common, save that of making a powerful impression on the nervous system. Of these *antiperiodic* agents cinchona and arsenious acids stand pre-eminent for their greater frequency of success, and, therefore, are those usually resorted to. I have already made some remarks on their relative therapeutical value. They differ in two particulars; first, cinchona may be given, as an antiperiodic, in any quantity which the stomach can bear; whereas, arsenious acid must be exhibited in cautiously-regulated doses; secondly, there are two modes of attempting the cure of an intermittent by cinchona;—one is, to put an immediate stop to the disease by the use of very large doses of the remedy given a few hours prior to the recurrence of the paroxysm,—the other is to extinguish the disease gradually by the exhibition of moderate doses at short intervals during the whole period of the intermission, so that the violence of every succeeding paroxysm is somewhat less than that of the preceding one;—but in the case of the arsenious acid the latter method is alone safe, and, therefore, to be adopted.

It has been asserted that cinchona is admissible in the interval only of an intermittent fever; and that if it be exhibited during the paroxysm it has a tendency to prevent the subsidence of the latter. But this statement is much overcharged. Morton[2] and others have given it in almost every stage without injury. Dr. Heberden[3] observes, "the only harm which I believe would follow from taking the bark even in the middle of the fit is, that it might occasion a sickness, and might harass the patient by being vomited up, and might set him against it." It is, however, more efficacious during the interval, though it may not be absolutely hurtful in the paroxysm. Dr. Cullen[1] was strongly of opinion that the nearer the exhibition of the cinchona is to the time of accession, the more certainly effectual will it be. I have already stated that arsenious acid may be given with good effect during the whole period (paroxysm and intermission) of the disease.

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[1] See some remarks on periodic movements in Müller's *Elem. of Phys.* by Baly, vol. i. p. 924.

[2] *Pyretologia.*

[3] *Comment.* art. *Feb. Interm.*

A very necessary condition to its perfect success is that it sit well on the stomach; for if it occasion vomiting or purging it is much less likely to act beneficially. Hence an emetic and a purgative are recommended to precede its employment. The use of these is more especially necessary if the disease be recent. For an adult, about fifteen grains of ipecacuanha, with a grain of tartarised antimony, may be exhibited as an emetic, unless there be symptoms of determination to the brain, or of inflammation of the digestive organs. A senna draught, with a calomel pill, forms a good purgative. To enable it to sit well on the stomach, cinchona (or the sulphate of quina) is frequently given in conjunction with aromatics. The infusion or decoction of cinchona, though much less effective, is, however, less liable to disturb the stomach than the powder of cinchona or the sulphate of quina. Opium is sometimes a necessary adjunct to cinchona to prevent its running off by the bowels. In some cases where the stomach was too irritable to admit of the administration of cinchona or sulphate of quina by the *mouth*, these agents have been otherwise introduced into the system. Thus *clysters* of cinchona were used by Helvetius, Torti, and Baglivi.[2] Van Swieten[3] says he has often seen this method successful in infants; but that it takes three times as much bark as would suffice if the remedy were swallowed. *Cataplasms* of cinchona have also been employed. Rosenstein applied them to the abdomen; Torti to the wrist.[4] Alexander[5] cured an ague by a *pediluvian* of decoction of cinchona; but Heberden[6] tried it without success. *Bark jackets* were employed with success in the agues of children by Dr. Pye.[7] They consisted of waistcoats between whose layers powdered cinchona was quilted. The dry powder of cinchona has been *applied to the skin*: thus Dr. Darwin strewed it in the patient's bed. Chrestien[8] successfully used the tincture and alcoholic extract by the *iatraleptic method*. More recently sulphate of quina has been employed in the same way. The last-mentioned operation has also been applied by the *endermic method*:[9] but this mode of using it is sometimes attended with intense pain and an eschar.[10] To infants at the breast Rosenstein advises its indirect exhibition *by the nurse*, in whose milk its active principle is administered to the child.[1] More recently sulphate of quina mixed with tobacco (in the proportion of fifteen grains of the former to an ounce of the latter) has been employed as a *snuff* in intermittent headache.

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[1] *Mat. Med.* ii. 96.
[2] Murray, *App. Med.* i. 871.
[3] *Commentaries*, vii. 277.
[4] Murray, *op. cit.* 872.
[5] *Exper. Essays*, 38.
[6] *Comment.*
[7] *Med. Obs. and Inq.* ii. 245.
[8] *De la Méthode Iatralept.* 232 and 270.
[9] *Archiv. Gen. de Méd.* 1826; *Revue Méd.* 1827.
[10] Trousseau and Pidoux, *Traité de Thérap.* ii. 219.

Cinchona and its preparations prove most successful in the simple or uncomplicated form of intermittents; that is, where the disease appears to be purely nervous. But when agues are accompanied with inflammatory excitement or with visceral disease, cinchona generally proves either useless or injurious. In remittents it proves much less successful than in regularly-formed intermittents. In all these cases we endeavour to promote the efficiency of the cinchona by reducing the disease to the form of a pure or simple intermittent. The means to effect this must of course depend on a variety of circumstances; but blood-letting, both general and local, purgatives, and diaphoretics, are those which for the most part will be found available. Under some circumstances, mercury given in alterative doses, or even as a very slight sialogogue, proves beneficial.

Intermittent fevers are not the only periodical diseases in which cinchona has been found beneficial. It is a remedy which has proved serviceable in several other cases in which a paroxysm (of pain, spasm, inflammation, hemorrhage, or fever) returns at stated periods. Thus intermittent neuralgia, rheumatism, headache, amaurosis, catarrh, ophthalmia, stricture, &c., have been greatly benefited by its use. Some of these affections have been regarded as *masked agues*. When periodical diseases recur at uncertain periods, as in the case of epilepsy, no particular advantage can be expected from the use of cinchona.

2. *In continued fever.*—In the latter stage of continued fever, when the vital powers are beginning to sink, and when there is no marked and decided symptoms of inflammatory disease of the brain or digestive organs, cinchona or sulphate of quina sometimes proves highly beneficial. If the tongue be dry, as well as furred, and the skin hot and dry, no advantage, but the reverse, can be anticipated from its employment. It is most applicable to the low forms of fever occurring in debilitated constitutions. When exacerbations or remissions, however indistinct, occur at regular periods, the administration of cinchona is the more likely to be followed by good effects. Under the preceding circumstances there can scarcely be two opinions as to the admissibility of bark. But on the general propriety of administering this remedy in continued fever, considerable difference of opinion has prevailed.[2] Dr. Heberden[3] cautiously observes, "I am not so sure of its being useful, as I am of its being innocent." In order to avoid offending the stomach, it is frequently advisable to begin with the infusion, for which, afterwards, first the decoction, then the sulphate of quina, may be substituted. In the stage of convalescence, the use of cinchona or sulphate of quina may often be advantageously preceded by infusion of calumba; without this precaution, irritation of the stomach or febrile symptoms are readily set up.

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[1] Trousseau and Pidoux, *Traité de Thérap.* ii. 231.

[2] Clutterbuck, *On the Seat and Nature of Fever*, 399, 2nd edit. 1825.

[3] *Comment.*

3. *In inflammatory diseases.*—As a general rule, stimulants and tonics, as cinchona, are improper in inflammatory diseases. Yet to this statement, which applies principally to the first stage, to acute and active cases, and to the disease when it occurs in strong and vigorous habits, many exceptions exist. Thus when it takes place in old and debilitated constitutions; when it is of a mild or atonic character, and has existed for some time without giving rise to any obvious organic changes; when it assumes an intermittent or even remittent form; or when it is of a certain quality, which experience has shown to be less benefited by ordinary antiphlogistic measures, cinchona is sometimes admissible and advantageous after evacuations have been made proportioned to the activity of the disease and the vigour of the system. *In scrofulous inflammation* (as of the eye) its value is fully appreciated. *In rheumatism*, in which disease Morton, Fothergill, Saunders, and Haygarth, have so strongly recommended it, its use is now obsolete, except under circumstances similar to those which regulate its employment in ordinary inflammation. The same remarks apply to its employment in *erysipelatous inflammation*, in which it was at one time much esteemed.

4. *In maladies characterised by atony and debility.*—Cinchona is useful in a great variety of diseases dependent on, or attended by, a deficiency of tone or strength, as indicated by a soft and lax condition of the solids, weak pulse, incapability of great exertion, impaired appetite, and dyspeptic symptoms. Thus, *in chronic atonic affections of the alimentary canal*, it proves very serviceable, especially in some forms of dyspepsia and anorexia. In these it should be given half an hour or an hour before meal-times. *In some chronic maladies of the nervous system*, as chorea, when it occurs in delicate girls; also in the neuralgia of weakly subjects. Disulphate of quina has been used by Dr. Bright[1] in tetanus. *In mortification*, it is useful in those cases in which tonics and astringents are obviously indicated; but it has no specific power of checking the disease, as was formerly supposed. *In passive hemorrhages*, from relaxation of vessels, as in some cases of profuse menstruation, or uterine hemorrhage consequent on miscarriage. *In profuse mucous discharges* with great debility, as in leucorrhœa, excessive bronchial secretion, old diarrhœas, &c. *In cachectic diseases*, as enlargements and indurations of the absorbent glands, of a scrofulous nature, strumous ophthalmia, obstinate ulcers, &c.[2] Also in venereal diseases, when the secondary symptoms occur in shattered and broken-down constitutions, and after the full use of mercury. Likewise in some of the chronic skin diseases, which are seen in cachectic habits.

5. *In the convalescence* of either acute or chronic lingering diseases, as fever, inflammation, hemorrhage, profuse suppuration, &c.; also after important surgical operations, when the strength is greatly reduced. In no class of cases is the efficacy of cinchona or its alkaloids more manifest than in these.

6. *As a topical astringent and antiseptic.*—The efficacy of cinchona as

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[1] *Guy's Hospital Reports*, vol. i.

[2] See Dr. J. Fordyce, *Med. Obs. and Inq.* i. 184.

an astringent and antiseptic depends on tannic acid. But as many vegetable substances exceed cinchona in the quantity of this acid which they contain, so they surpass it in astringency. Hence the topical uses of bark are comparatively unimportant; and, for the most part, are nearly obsolete. Powdered cinchona is frequently employed as a tooth powder. Formerly it was used as an application to mortified parts, foul ulcers, caries, &c. The decoction, with or without hydrochloric acid, is applied as a gargle in putrid sore-throat.

7. *As a chemical antidote.*—The value of cinchona bark, as a chemical antidote, depends on its tannic acid. I have already offered some observations on its employment in poisoning by emetic tartar. I believe in all cases it might be advantageously replaced by other and more powerful astringents; as nutgalls, or, on an emergency, green tea.

ADMINISTRATION.—In the form of *powder*, cinchona is now rarely administered. The bulk of a full dose, its disagreeable taste, its tendency to cause nausea and vomiting, and the quantity of inert woody fibre which it contains, form great objections to its employment. Yet of its great efficacy, as a febrifuge or antiperiodic, in intermittents, and of its superiority in these cases to the decoction or infusion, no doubt can exist; but sulphate of quina has almost entirely superseded it. The dose of the powder of cinchona is from a scruple to a drachm, or even more than this when the stomach can bear it.

1. **INFUSUM CINCHONÆ**, L. E.; *Infusion of Bark.* (Yellow Cinchona [any species of Cinchona, according to prescription, *E.*], bruised [in powder, *E.*], ℥j.; Boiling [Distilled, *L.*] Water, Oj. Macerate for two [four, *E.*] hours in a covered vessel, and strain [through linen or calico, *E.*])—Water extracts from cinchona bark the kinates of quina, cinchonia, and lime, gum, soluble red cinchonic (tannic acid) and yellow colouring matter. The greater part of the cinchona alkaloids remains in the marc, as a very small quantity only of the compound of red cinchonic and the cinchona alkaloids is extracted. The London College has very properly directed yellow bark (the most powerful of the cinchona barks) to be used in the preparation of the infusion.—The infusion of cinchona is stomachic and tonic, but is scarcely energetic enough to be febrifuge. It is a light preparation, applicable as a tonic where the stomach is very delicate, and cannot support the more active preparations of this medicine. —The dose is f℥j. to f℥ij. thrice a-day.

2. **INFUSUM CINCHONÆ PALLIDÆ**, L.; *Infusum Cinchonæ*, D.; *Infusion of Pale Bark.* (Prepare this in the same manner as Infusum Cinchonæ, *L.*—Take of Peruvian Bark (Crown or Pale), in coarse powder, ℥j.; Boiling Water, Oss. Infuse for one hour in a covered vessel, and filter through paper. The product should measure about eight ounces, *D.*) —Dose, ℥j. to ℥ij. This infusion is inferior to the preceding in activity, and is a very unnecessary one. It is said to oppress the stomach less than that of the other cinchona bark: the reason is obvious,—it is weaker.

3. **INFUSUM CINCHONÆ SPISSATUM**, L.; *Inspissated Infusion of Bark.* (Yellow Cinchona, coarsely powdered, lbiij.; Distilled Water, Ovj.;

Rectified Spirit, as much as may be sufficient. Macerate the cinchona in the same manner as the Extractum Cinchonæ is directed to be prepared, and strain. Evaporate the mixed infusions, in a water-bath, to a fourth part, and set aside that the dregs may subside. Pour off the clear liquor, and strain what remains. Then mix them, and again evaporate until the sp. gr. of the liquor becomes 1·200. Into this, when it has become cold, drop the spirit very slowly, that three fluidrachms may be added to each fluidounce of the liquor. Lastly, set aside the liquor for twenty days that the dregs may entirely subside.)—Concentrated solutions of this kind have long been in use to save trouble in preparing the ordinary infusion. The inspissated infusion of the College is said to be from twenty-four to thirty-six times the strength of the pharmacopœial ordinary infusion; but it is obvious that the preparation must be liable to variation in strength. In a general way, fʒj. may be considered equal to f℥iij. of the infusion.

4. INFUSUM CINCHONÆ PALLIDÆ SPISSATUM, L.; *Inspissated Infusion of Pale Bark.* (Prepare this in the same manner as Infusum Cinchonæ spissatum.)—An unnecessary preparation. Its properties are similar to those of the preceding preparation, but its strength is less.

[**5. INFUSUM CINCHONÆ COMPOSITUM**, U. S.; *Compound Infusion of Cinchona Bark.*—Take of Red Bark, in powder, an ounce. Aromatic Sulphuric Acid, a fluidrachm: Water, a pint. Macerate for twelve hours, occasionally shaking, and strain. It may also be prepared by displacement.—Ed.]

6. DECOCTUM CINCHONÆ, L. E.; *Decoction of Bark.* (Yellow Bark, bruised, ʒx.; Distilled Water, Oj. Boil for ten minutes in a covered vessel, and strain the liquor while hot, *L.*—Crown, Grey, Yellow, or Red Cinchona, bruised, ℥j.; Water, f℥xxiv. Mix them, boil for ten minutes, let the decoction cool, then filter it, and evaporate to sixteen fluidounces, *E.*)—The preparation of the London College becomes turbid on cooling: the Edinburgh College directs the preparation to be filtered after it has become cold.

By boiling, water extracts from cinchona the kinates of quina, cinchonia, and lime, gum, soluble red cinchonic (tannic acid), yellow colouring matter, starch, and a portion of the compound of the red cinchonic with the cinchona alkaloids. While hot, the liquor is transparent; but, as it cools, it becomes turbid,—owing partly to the deposition of the tannate of starch when the temperature falls below 88° F., and partly because the red cinchonic compound, being more soluble in hot than in cold water, is deposited on cooling. If the deposit, with a portion of the supernatant liquor, be poured off and gently heated, it is dissolved. The sesquichloride of iron almost blackens it: a few drops of sulphuric acid and a few drops of solution of iodine render it bluish-black,—indicative of the presence of starch. Of 146 parts of the deposit from decoction of yellow (Calisaya) bark, Soubeiran[1] found 60 parts (principally tannate of starch) were insoluble in alcohol, and the remaining 86 parts were readily soluble in alcohol, and yielded the cinchona alkaloids. The same author also found that, by decoction, yellow (Calisaya) bark lost two-thirds of its weight; whereas, by infusion, it merely lost one-third of its weight. If the water employed in preparing the decoction or infusion be acidulated (with sulphuric or hydrochloric acid), the medicinal value of the preparation is greatly increased; for the acid decomposes the insoluble red cinchonic salt, and forms with the cinchona alkaloids a soluble combination. Alkaline solutions, on the other hand, yield less powerful, though highly coloured, preparations: they readily dissolve the red cinchonic and the acids, but they render the alkaloids insoluble. Decoction of cinchona is stomachic, tonic, and febrifuge.—The dose is f℥j. to f℥ij.

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[1] *Traité de Pharm.* i. 607.

7. **DECOCTUM CINCHONÆ PALLIDÆ,** L.; *Decoctum Cinchonæ,* D.; *Decoction of Pale Bark.* (Prepared like Decoctum Cinchonæ, *L.*—Take of Peruvian Bark [Crown or Pale], in coarse powder, ℥ss.; Water, Oss. Boil for ten minutes in a covered vessel, and strain while hot. The product should measure about eight ounces, *D.*)—The properties, uses, and doses are like the preceding preparation, than which it is weaker.

8. **DECOCTUM CINCHONÆ RUBRÆ,** L.; *Decoction of Red Bark.* (Prepared like Decoctum Cinchonæ.)—Its properties, uses, and doses are similar to those of Decoctum Cinchonæ, *L.*

[9. **DECOCTUM CORTICIS CINCHONÆ REGII ACIDIUM,** *Pharm. Norveg. Acid Decoction of Pale Bark.* Take of Peruvian (Pale) Bark, bruised, eight parts; of Diluted Sulphuric Acid, one part. Boil in a porcelain vessel for a quarter of an hour with so much water that when strained there may be eight parts of the decoction.

10. **DECOCTUM CORTICIS CINCHONÆ REGII CUM POLYGATA,** *Pharm. Norveg. Decoction of Peruvian (Pale) Bark, with Decoction of Senega.* Take of Peruvian (Pale) Bark, bruised, three parts. Of Senega Root, sliced, one part. Let them be boiled for half an hour to make, when strained, forty parts of decoction—ED.]

11. **TINCTURA CINCHONÆ,** L. E.; *Tincture of Bark.* (Yellow [Yellow, or any other species, according to prescription, *E.*] Cinchona, bruised [in fine powder, *E.*], ℥viij.; Proof Spirit, Oij. Macerate for seven days, then express and strain. The directions of the *Edinburgh College* are as follows: "Percolate the bark with the spirit, the bark being previously moistened with a very little spirit, left thus for ten or twelve hours, and then firmly packed in the cylinder. This tincture may also be prepared, though much less expeditiously, and with much greater loss, by the usual process of digestion, the bark being in that case reduced to coarse powder only.")—Spirit extracts all the bitter and astringent principles of cinchona,—both the kinates of the cinchona alkaloids, as well as the combination of these substances with the red cinchonic. If the spirit be too concentrated, the kinates are less readily dissolved by it. Tincture of cinchona is stomachic, tonic, and stimulant.—The dose is fʒj. to fʒiij. It is

usually employed as an adjuvant to the infusion or decoction of cinchona, or to the solution of the disulphate of quina.

12. TINCTURA CINCHONÆ PALLIDÆ, L.; *Tinctura Cinchonæ*, D.; *Tincture of Pale Bark.* (Prepared like Tinctura Cinchonæ, *L.*—Take of Peruvian Bark [Crown or Pale], in coarse powder, ℥viij.; Proof Spirit, Oij. Macerate for fourteen days, strain, express, and filter, *D.*—Properties, uses, and doses as the preceding preparation, than which it is weaker.

13. TINCTURA CINCHONÆ COMPOSITA, L. E. D.; *Compound Tincture of Bark.* (Pale Cinchona (Yellow Bark, *E.*], bruised [coarsely powdered, *D. E.*; fine, if percolation be followed, *E.*], ℥iv.; Orange Peel [Bitter *E. D.*], dried [bruised, *E.*], ℥iij. [℥ij. *D.*]; Serpentary, bruised, ʒvj.; Saffron [chopped, *E. D.*], ʒij.; Cochineal, powdered, ʒj.; Proof Spirit, Oij. Digest for seven [fourteen, *D.*] days, then express and strain. "Digest for seven days; strain and express strongly; filter the liquors. This tincture may also be conveniently prepared by the method of percolation, in the same way as the compound tincture of cardamom," *E.*) —This is usually sold as *Huxham's Tincture of Bark.* It is a more agreeable and more stimulant, though less powerful, tonic than the simple tincture, and is less apt to disturb the stomach. Made according to the London Pharmacopœia, it contains one half less cinchona than the simple tincture. It is employed as a tonic and stomachic.—The dose of it is fʒj. to fʒiij. [The corresponding preparation in the Norwegian Pharmacopœia, is called Essentia Corticis Cinchonaæ Regii Composita. It is thus made:—Take of Pale Cinchona Bark equal parts, Gentian Root four parts, and Orange Peel one part. To these substances, coarsely bruised or sliced, add of Rectified Spirit (0·833) sixty-five parts. It should be boiled in a water bath for half an hour, the vapour of the spirit being collected in a condenser. After expression and filtration, Rectified Spirit should be added to make up the original quantity.—Ed.]

14. EXTRACTUM CINCHONÆ, L. E.; *Extract of Bark.* (Yellow Bark, coarsely bruised. lbiij.; Distilled Water, Ovj. Add four pints of water to the cinchona, and stir constantly with a spatula until the bark is thoroughly moistened: macerate for twenty-four hours, and strain through linen. Macerate the residuum in the remaining water for twenty-four hours, and strain. Then evaporate the mixed liquors to a proper consistence, *L.*—Take any of the varieties of Cinchona, but especially the Yellow or Red Cinchona, in fine powder, ℥iv.; Proof Spirit, f℥xxiv. Percolate the cinchona with the spirit; distil off the greater part of the spirit; and evaporate what remains in an open vessel over the vapour-bath to a due consistence, *E.*)—The *watery extract of cinchona* (*extractum cinchonæ*, L.) contains the same constituents already mentioned as being found in decoction of bark. Mr. Brande says lance-leaved (*i.e.* pale) bark yields 30 per cent. of watery extract. The active principles of this preparation are the kinates of the cinchona alkaloids. The *spirituous extract* (*extractum cinchonæ*, E.) is a more efficacious preparation, as it contains, besides the alkaline kinates, the compound of the red cinchonic with the cinchona alkaloids. When prepared with rectified spirit, 24 per cent. of extract is obtained from pale bark. But as the *Edinburgh College* direct proof spirit to be employed, the produce is larger.—Well-prepared (*i. e.* not decomposed by evaporation) extract is a very useful preparation, which, however, has been nearly superseded by sulphate of quina. It is given in the form of pill, in doses of from grs. v. to grs. xx. The watery extract may be dissolved in water or in infusion of roses; and for administration to children, in syrup of mulberries or of orange peel. Extract of bark, however, is rarely employed in medicine.

15. EXTRACTUM CINCHONÆ PALLIDÆ, L.; *Extract of Pale Bark.*

16. EXTRACTUM CINCHONÆ RUBRÆ, L.; *Extract of Red Bark.*

These two extracts are prepared in the same manner as Extractum Cinchonæ, *L.*

17. QUINÆ DISULPHAS, L.; *Quinæ Sulphas,* E. D.; *Sulphate of Quinine,* offic.; *Subsulphate of Quina.*—[Although the *Disulphate of Quina* is now placed by the London College among the articles of Materia Medica, we have considered it proper to retain the author's description of the method of preparing this salt according to the formula of previous editions of the Pharmacopœia.—ED.]

Take of Heart-leaved Cinchona, bruised, lb. vij.; Sulphuric Acid, ℥ix.; Purified Animal Charcoal ℥ij.; Hydrated Oxide of Lead; Solution of Ammonia; Distilled Water, each as much as may be sufficient. Mix four ounces and two drachms of the Sulphuric Acid with six gallons of distilled Water, and add the Cinchona to them; boil for an hour and strain. In the same manner again boil what remains in Acid and Water, mixed in the same proportions, for an hour, and again strain. Finally, boil the Cinchona in eight gallons of distilled water and strain. Wash what remains frequently with boiling distilled water. To the mixed liquors add Oxide of Lead, while moist, nearly to saturation. Pour off the supernatant liquor, and wash what is thrown down with distilled water. Boil down the liquors for a quarter of an hour, and strain; then gradually add Solution of Ammonia to precipitate the Quina. Wash this until nothing alkaline is perceptible. Let what remains be saturated with the rest of the Sulphuric Acid, diluted. Afterwards digest with two ounces of Animal Charcoal, and strain. Lastly, the Charcoal being thoroughly washed, evaporate the liquor cautiously, that crystals may be produced.

Mr. Phillips[1] gives the following explanation of this process. "The quina exists in combination with a peculiar acid, called Kinic Acid, forming with it Kinate of Quina, which is soluble to a certain extent in water, and is rendered more so by the sulphuric acid employed in the process, and perhaps by decomposing it. Whatever may be the state of combination, the solution contains sulphuric acid, kinic acid, and quina, mixed with extractive and colouring matter, the latter being got rid of by the animal charcoal. On adding oxide of lead the sulphuric acid combines with it, and the resulting sulphate being insoluble is precipitated, while the kinic acid and quina remain in solution; when ammonia is added, after the separation of the sulphate of lead, the kinic acid unites with it, and the kinate of ammonia formed is soluble, while the quina is precipitated, and this, when afterwards combined with sulphuric acid, forms disulphate of quina, which crystallises."

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[1] *Transl. of the Pharm.*

The directions of the *Edinburgh College* for the preparation of disulphate of quina are as follows:—

Take of Yellow Bark, in coarse powder, one pound; Carbonate of Soda, eight ounces; Sulphuric Acid, half a fluidounce; Purified Animal Charcoal, two drachms. Boil the bark for an hour in four pints of water, in which half the carbonate of soda has been dissolved; strain and express strongly through linen or calico; moisten the residuum with water, and express again, and repeat this twice. Boil the residuum for half an hour with four pints of water, and half the sulphuric acid; strain, express strongly, moisten with water, and express again. Boil the residuum with three pints of water and a fourth part of the acid; strain and squeeze as before. Boil again the residuum with the same quantity of water and acid; strain and squeeze as formerly. Concentrate the whole acid liquors to about a pint; let the product cool; filter it, and dissolve in it the remainder of the carbonate of soda. Collect the impure quina on a cloth, wash it slightly, and squeeze out the liquor with the hand. Break down the moist precipitate in a pint of distilled water; add nearly one fluidscruple of sulphuric acid, heat it to 212°, and stir occasionally. Should any precipitate retain its grey colour, and the liquid be neutral, add sulphuric acid, drop by drop, stirring constantly till the grey colour disappears. Should the liquid redden litmus, neutralise it with a little carbonate of soda. Should crystals form on the surface, add boiling distilled water to dissolve them. Filter through paper, preserving the funnel hot; set the liquid aside to crystallise; collect and squeeze the crystals; dissolve them in a pint of distilled water heated to 212°; digest the solution for fifteen minutes with the animal charcoal; filter, and crystallise as before. Dry the crystals with a heat not exceeding 140°.

The mother-liquors of each crystallisation will yield a little more salt by concentration and cooling.

The object of this process is to extract, by means of the solution of carbonate of soda, the acids, the colouring and extractive matters, the gum, &c. from the bark, but leaving the cinchona alkaloids. Stolze used for this purpose lime; Badollier and Scharlau caustic potash. The alkaline decoction has a very deep colour. By boiling the residuum in water acidulated with sulphuric acid, the alkaloids are dissolved. On the addition of carbonate of soda, double decomposition takes place, and the impure quina is precipitated. This is afterwards dissolved in water acidulated with sulphuric acid, and the filtered liquid is set aside to crystallise. The impure disulphate of quina thus obtained is re-dissolved in boiling water, and the solution, after being decolorised by digestion with animal charcoal, is filtered, and put aside to crystallise.

I have repeated this process, which has the great merit of obviating the use of alcohol, and I believe it to be an excellent one, combining both simplicity and economy. In one experiment I employed one lb. of picked uncoated yellow (Calisaya) bark, and found that the precipitated impure quina required two fluidscruples and five minims of sulphuric acid to saturate it, instead of one fluidscruple, directed by the Edinburgh College. In another experiment I could not get the impure sulphate of quina to crystallise until it had been digested with animal charcoal.

The process of the *Dublin College* is similar to the method of manufacturing disulphate of quina which has been usually followed by *manufacturers* in this country: it is as follows:—

Coarsely pulverised yellow (Calisaya) bark is boiled with water acidulated with sulphuric or hydrochloric acid. The residuum boiled a second or a third time with acidulated water. Some repeat the process a fourth time. Finely-powdered slacked lime is added to the filtered decoction (when cold), until the liquor is sensibly alkaline, and acquires a dark colour. The precipitate is collected, drained on a cloth, and then submitted to graduated pressure (usually in a hydraulic press). The cake thus obtained is, when dry, reduced to powder, and digested in rectified spirit. The filtered tincture is distilled until the residuum (impure quina) in the retort has a brown viscid appearance. This residuum is then to be carefully saturated with very diluted sulphuric acid, the solution filtered, and set aside to crystallise. The disulphate of quina thus obtained is yellowish-brown. It is drained in a cloth, compressed, dissolved in water, decolorised by animal charcoal, re-crystallised, and dried. This last part of the process must be very carefully conducted, to avoid efflorescence.

Some persons think it preferable to convert the quina of this alcoholic solution into a sulphate before distillation, in order to separate the fatty matter. I am informed, by a maker of this salt, that the use of spirit in the process does not, on the large scale, add much more than a penny an ounce to the cost of the disulphate, as the greater part is recovered.

On the large scale the decoction of the bark is usually prepared in a large vat, the boiling being effected by steam. The acidulated decoction contains the quina, the cinchonia, the yellow colouring matter, the red cinchonic, the kinic, and the sulphuric (or hydrochloric) acids. The lime saturates all the acids, and forms soluble salts (if sulphuric acid have been employed, sulphate of lime is formed, the greater part of which precipitates), which remain in the liquid with a portion of red colouring matter. The precipitate is composed of quina, cinchona, a combination of lime and red cinchonic, fatty matter, excess of lime, and, when sulphuric acid has been employed, sulphate of lime: the whole is contaminated with colouring matter. Alcohol extracts from this precipitate the quina and cinchonia, the fatty matter, and the colouring matter; leaving undissolved the excess of lime, the compound of lime with the red cinchonic, and, when sulphuric has been used, sulphate of lime. The sulphuric acid being then added to the impure quina, converts it into a disulphate. On account of the expense of spirit of wine, various substitutes have been proposed. Pyroxilic spirit has been tried; but I believe has not answered. Pelletier has taken out a patent for the employment of a volatile oil (oil of turpentine). The dried cake of quina and lime, obtained in the usual manner, is to be digested in oil of turpentine, which dissolves the quina. The oleaginous solution is then to be agitated with water acidulated with sulphuric acid, by which a sulphate of quina is obtained. By repose, the oil rises to the top, and after removal may be employed again, while the solution of the sulphate is to be evaporated as usual. Hitherto, however, this process has not succeeded, partly because the turpentine does not extract more than nineteen-twentieths of the quina present. If any attempts, however, should be made to procure the disulphate in America, it is possible that some modification of this process would be the best.

[Herring has patented a process in which *benzole* is used to dissolve the quina that may be recovered from the alkaline infusion in which the acids and colouring matter of bark are separated from the other principles.[1]—ED.]

Disulphate of quina occurs in small, fibrous, odourless, very bitter crystals, which have a pearly aspect, and a flexibility like amianthus. Exposed to the air, they effloresce slightly. When heated they become luminous; friction promotes this phosphorescence. At 212° F. they lose 7 atoms of water, or 14·45 per cent. At 240° F. they melt like wax; at a more elevated temperature the salt assumes a fine red colour; and when ignited in the air burns, leaving at first a carbonaceous residuum, but which is subsequently dissipated. One part of this salt requires 80 parts of cold alcohol (sp. gr. 0·850) or 740 parts of cold, or 30 parts of boiling, and more than 700 parts of cold, water to dissolve it: as the saturated solution cools, part of the salt separates. A remarkable property of this salt is to give a blue tinge to the surface of water (see *Quina*, ante). The following is the composition of this salt:—

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[1] *Pharm. Journal*, vol. xiii. p. 210.

	Atoms.	*Eq. Wt.*	*Per Cent.*
Sulphuric Acid	1	40	9·17
Quina	2	324	74·31
Water	8	72	16·52
Crystallised Disulphate of Quina	11	436	100·00

By exposure to the air the crystals lose 4 (Soubeiran says 6) equivalents of water, equal to about eight per cent. When fused they evolve two more equivalents. One hundred grains of the crystals dissolved in water, acidulated with hydrochloric acid, yield by the addition of chloride of barium a quantity of sulphate of baryta, which when ignited weighs 26·6 grs. For the tests, see *Quina*, ante.

Adulterations.—Various foreign bodies (as earthy and alkaline salts, gum, sugar, starch, fatty matters, sulphate of cinchonia and of quinidine, and salicine) are, it is said, occasionally intermixed with disulphate of quina. The following are the tests by which the presence of these bodies is ascertained:—By digesting disulphate quina in alcohol this salt is dissolved, leaving any alkaline or earthy sulphates, gum, or starch, that may be present. Gum is soluble in cold water; starch is coloured blue by a solution of iodine. When heated in the open air the disulphate of quina is burned and dissipated: the earthy salts, on the other hand, are left. The disulphate is soluble in water acidulated with sulphuric acid, whereas fatty matters are insoluble. To detect sugar, add to a solution of the disulphate, carbonate of potash: quina is precipitated, while sulphate of potash and sugar are left in solution: the latter may be detected by its sweet taste, or by evaporating the liquid to dryness, and digesting the residue with spirit, which dissolves the sugar, but leaves the sulphate. Ammoniacal salts are detected by the ammoniacal odour emitted on the addition of caustic potash. Salicine may be recognised by oil of vitriol, which turns it red. Sulphate of cinchonia may be made to crystallise, in a pulverulent form, by stirring the solution, and in this state it may be readily intermixed with disulphate of quina. This fraud, I suspect, has been recently carried on to no very slight extent. To detect it, precipitate a solution of the suspected salt in water by potash; collect the precipitate, and boil it in alcohol. The cinchona crystallises as the liquor cools, while the quina remains in the mother-liquor. [Or Schweitzer's[1] ether test may be used by precipitating the suspected specimen by liquor ammoniæ and then adding ether, when the quina will be dissolved, but the cinchonia will float undissolved between the two liquids. This test is recommended by the French government (*Annuaire de Thérapeutique*, 1855, p. 166.), who refuse to allow the sale of sulphate of quina containing more than 3 per cent. of cinchonine. The same test will indicate the presence of quinidine, but this is partly soluble in ether.—ED.]

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[1] *Pharm. Journal*, vol. xiii. p. 666.

The characteristic marks of the purity of disulphate quina are, according to the *London College*, as follows:—

> "It is dissolved by water, especially when mixed with an acid. Quina is thrown down by ammonia; the liquor being evaporated ought not to taste of sugar. One hundred parts of disulphate of quina lose eight or ten parts of water by a gentle heat. It is destroyed by heat. Chlorine being first added to it, and afterwards ammonia, it becomes green." From 100 grains dissolved in water mixed with hydrochloric acid, 26·6 grains of sulphate of barytes, dried at a red heat, are obtained.

The characters given by the *Edinburgh College* are as follows:—

> "A solution of ten grains in a fluidounce of distilled water, and two or three drops of sulphuric acid, if decomposed by a solution of half an ounce of carbonate of soda, in two waters, and heated till the precipitate shrinks and fuses, yields, on cooling, a solid mass, which, when dry, weighs 7·4 grains, and in powder dissolves entirely in a solution of oxalic acid."

The quantity of carbonate of soda required to decompose 10 grs. of disulphate of quina, to which a few drops (say six grains) of sulphuric acid have been added, is less than twenty-five grains.[1]

Disulphate of quina is given in doses of from gr. j. to grs. v. Occasionally it is exhibited in much larger doses as a febrifuge: but it is very apt to disagree, causing disturbance of stomach, febrile disorders, and headache. I have known fourteen grains taken, and have heard of a scruple or half a drachm being exhibited at a dose. It may be given either in the form of pill, made with conserve of roses, or dissolved in some aqueous liquid by the aid of an acid. Infusion of roses is a favourite vehicle for it. An ointment (composed of ʒj. of disulphate of quina and ʒij. of lard) rubbed into the axilla has been used with success to cure ague in children.[2]

[Mr. R. Howard[3] states that the admixture of quinidine with quina may be detected by boiling 100 grains of the suspected salt in two ounces of water: it will not be entirely dissolved if it is entirely quina; but on adding 2 ounces more water, and again boiling, a clear solution will be obtained, from which, after cooling for six hours, only 10 grains of pure quina would remain in solution, but of quinidine no less than 46 grains: hence, the crystals in one case would weigh 90, in the other 54 grains.—ED.]

18. **TINCTURA QUINÆ COMPOSITA**, L.; *Compound Tincture of Quinine.* (Disulphate of Quinine, ʒv. and ℈j.; Tincture of Orange, Oij. Digest for seven days, or until the quina be dissolved, and strain.)—The solution is hastened by digesting the mixture in a warm place. Mr. Squire states that in seven days only 39-40ths of the quina are dissolved. Every fluidrachm contains about one grain of the disulphate.—Dose, fʒj. to fʒij. or more.

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[1] Mr. R. Phillips, *Lond. Med. Gaz.* Aug. 17, 1839.
[2] *Lond. Med. Gaz.* April 3, 1840.
[3] *Pharm. Journ.* vol. xi. p. 393.

19. QUINÆ MURIAS, D.—A process for preparing this salt is given in the Dublin Pharmacopœia. It is procured in decomposing a solution of Disulphate of Quina by a solution of Chloride of Barium. It is employed in the preparation of the Valerianate of Quinine.

20. QUINÆ VALERIANAS, D.—This salt is prepared in decomposing Muriate of Quina by the Valerianate of Soda (see *ante*).

240. UNCARIA GAMBIER, *Roxburgh.*—THE GAMBIR.

Nauclea Gambir, *Hunter.*
Sex. Syst. Pentandria Monogynia.
(The extract obtained from the leaves, *E.*; Gambir, or Gambir-Catechu.)

HISTORY.—*Gambier*, or *Gambir*, is the Malay name of an extract obtained from the leaves of this shrub. Rumphius[1] has described the plant under the name of *Funis uncatus* or *Daun Gatta Gambir.*

BOTANY.—**Gen. Char.** —Limb of *calyx* short, urceolate, 5-cleft. *Corolla* funnel-shaped; tube slender; throat naked; lobes 5, spreading, oval-oblong. *Anthers* enclosed or protruded. *Style* filiform, protruded; *stigma* tumid, undivided. *Capsules* pedicellate, clavate, tapering to the base. *Seeds* numerous, imbricated, winged.—Climbing *shrubs*. *Peduncles* when old becoming axillary compressed hooked spines. *Flowers* in loose heads (Lindley; De Cand.)

Sp. Char.—*Branches* terete. *Leaves* ovate-lanceolate, acute, with short petioles, smooth on both sides. *Stipules* ovate. *Peduncles* axillary, solitary, opposite, bracteolated about the middle; the lowest ones sterile, converted into hooked spines (De Cand.)

A stout, scandent *shrub*. *Florets* green and pink. *Capsules* stalked, elevate, 2-celled, 2-valved.

Hab.—Islands of East Indian Archipelago. Extensively cultivated. On the Island of Bintang there are 60,000 *Gambir plantations.*[2]

EXTRACTION OF GAMBIR.—Two methods of obtaining Gambir are described: *one* consists in boiling the leaves in water, and inspissating the decoction; the *other*, which yields the best Gambir, consists in infusing the leaves in warm water, by which a fecula is obtained, which is inspissated by the heat of the sun, and formed into cakes.[3]

Dr. Campbell[4] has described the method of making the *circular* or *cylindrical* variety of Gambir, as followed in the colony established by the Sultan of Moco, where the manufacture is carried on to a considerable extent. It consists in shredding and bruising the young shoots and leaves "in water for some hours, until a fecula is deposited; this, inspissated in the sun to the consistence of a paste, is thrown into moulds of a circular form, and in this state the Gambir is brought to market." Dr. Roxburgh[5] describes the manufacture of the *cubical* variety as practised eastward to the Bay of Bengal. The process consists in "boiling the leaves and young shoots; evaporating the decoction by fire and the heat of the sun. When sufficiently inspissated, it is spread out thin, and cut into little square cakes, and dried." Mr. Bennett[1] has given a very full account of the method of making the *cubical* variety as practised at Singapore. The leaves are plucked from the prunings, and boiled in a *qualie*, or cauldron (made of bark, with an iron bottom); after being boiled twice and rinsed, they are used as a manure for the pepper vine. The decoction is evaporated to the consistence of a very thick extract, of a light, yellowish, brown colour, like clay, which is placed in oblong moulds. The pieces thus obtained are divided into squares, and dried in the sun on a raised platform. Hunter[2] says, sago is often intermixed with the extract, but Bennett denies that this is done at Singapore. [The decoction of the leaves is said to be thickened by the manufacturers at Singapore by stirring it with a piece of wood obtained from a tree of the country, which it is to be presumed supplies mucilaginous and starchy matters. Seemann, unfortunately, could not succeed in obtaining this wood from the Chinaman whose laboratory he visited.[3]—ED.] The best Gambir is made at Rhio, in the isle of Bintang; the next best is that of Lingin.

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[1] *Herb. Amboin.* vol. v. tab. 34.
[2] Bennett's *Wanderings*, ii.
[3] *Asiatic Researches*, xi. 188.
[4] Roxburgh, *Fl. Ind.* i. 518.
[5] *Ibid.*

COMMERCE.—Gambir (the cubical variety) is imported from Singapore principally. Its principal use here is for tanning; and among dealers it is distinguished from catechu, cutch, &c. by the name of *terra japonica*. The following quantities were imported during a period of four years:[4]—

In 1836	970 tons.	In 1838	1600 tons.
1837	2738 „	1839	5213 „

[This article is now free of duty, and the price has ranged for some time between 20s. and 36s. per cwt. It was formerly imported in baskets of rattan, but these proving very wasteful, it is now imported in pressed bales of about two hundredweight each, the covering being simply thin calico.—ED.]

DESCRIPTION AND VARIETIES.—*Gambir* (*Terra Japonica*, of tanners; *Catechu in square cakes*, of druggists; *Cubical Resinous Catechu*, of Guibourt; *Gambir of Second Quality*, Bennett),[5] occurs in cubes, whose faces are about one inch square. When thrown into water, it floats. These cubes are externally of a deep reddish or yellowish-brown colour; their fracture is dull and porous, and internally their colour is paler than that of their surface, being yellowish-cinnamon brown; the fractured surface not unfrequently presenting some darker feebly shining stripes, extending from without inwards. This kind has no odour; its taste is powerfully astringent and bitter, but subsequently becoming sweetish. It melts entirely in the mouth. When heated in a platinum crucible it undergoes a kind of semifusion, and swells up; and when incinerated leaves a light white ash. Nees v. Esenbeck[6] says twenty grains of this

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[1] *Wanderings*, ii. 183.

[2] *Linn. Trans.* ix.

[3] Hooker's *Journal of Botany*.

[4] Messrs. Powell's *Annual Price Current* for 1840.

[5] *Med. and Phys. Journ.* vol. lxvii.

[6] *Handb. d. med. pharm. Botan.* i. 881.

Gambir leave only half a grain of ash. It is partially soluble in cold water. When boiled in water it is almost completely dissolved, and yields a decoction which, while hot, is of a clear reddish-brown colour, but, on cooling, becomes turbid, owing to the deposition of catechine. By digestion in ether it forms a deep reddish-brown tincture, which, by evaporation, yields a reddish-brown astringent extract: the portion which is insoluble in ether is dark brown, tough and elastic. Examined by the microscope, Gambir is found to consist in great part of myriad of minute crystals (*catechine*) intermixed with a kind of mucous tissue.

Mr. Bennett[1] has described three qualities of Gambir, specimens of which are contained in my own collection, as well as in that of the *Medico-Botanical Society of London*. To these I must add a fourth, which I have received from Professor Guibourt.

1. Small Circular Moulded Gambir: *Gambir of the first quality*, Bennett; *Lozenge Gambir*.—This occurs in small round cakes, about the size of a small lozenge. Its form is something like that of a plano-convex lens, slightly flattened on the convex side. One of its surfaces is flat, round, about half an inch in diameter; the other one is convex, with a star-like pattern impressed on it. Its colour is pale pinkish-yellowish white. It has a chalky or earthy feel, and is brittle. Specimens of this are in the collection of the Medico-Botanical Society.

Amylaceous Lozenge Gambir.—Under the name of *Gambir*, or *China Catechu*, I have received from Bombay small circular cakes of Gambir adulterated with sago meal. The cakes are circular and cylindrical, about 3½ lines in diameter, and 2 lines thick; flat at the bottom, and slightly convex at the top. They are greyish yellowish white; have a cretaceous feel, and are easily reduced to powder. Their decoction when cold is rendered blue by tincture of iodine. Examined by the microscope multitudes of particles of sago may be detected, intermixed with crystals of catechine. I have received the same kind of Gambir from Dr. D. Maclagan, of Edinburgh, under the name of *White Gambir*.

2. Gambir in Parallelopipeds: *Gambir of the second quality*, Bennett.—This occurs in two forms: *cubes* (forming the Gambir of English commerce, described in the text), and *square prisms* or *oblong* pieces. The latter I received from Dr. Maclagan, of Edinburgh, under the name of *Yellow Gambir in parallelopipeds*. The length of the prisms is two inches; the size of the terminal faces half an inch square. In other respects the oblong variety agrees with the square kind.

3. Cylindrical Gambir: *Gambir of the third quality*, Bennett.—This occurs in circular discs, or short cylindrical pieces, the length of the cylinder being only about one-third of an inch, while its diameter is one inch and a quarter. One of the round surfaces is marked with the fibres of a cloth, on which the cakes have been dried. The colour internally is pale, dull, pinkish-yellow, externally being a shade darker. Its fracture is dull and porous. It is easily scraped to powder with the nail, and in this state has a chalky feel. Its taste is astringent, but less so than the other kinds; it is gritty under the teeth. It sinks in water. The samples in the Medico-Botanical Society are somewhat smaller than those which I have found in commerce. This kind contains many impurities.

4. Cubical Amylaceous Gambir.—It is in cubes, which swim in water, and whose faces are about half an inch square. Externally these cubes are dark brown, being darker coloured than the kind just described. Its fracture is dull and porous, its colour internally being pale cinnamon brown. It is readily distinguished from all other kinds of Gambir, by the black colour produced when the tincture of iodine is applied to the fractured surface. When digested in water it is resolved into two parts—

Matter soluble in water	45
Matter insoluble in water, principally amylaceous	55
	100

The amylaceous matter is probably sago.

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[1] *Med. and Phys. Journ.* lxvii.

COMPOSITION.—Gambir (the cubical variety) was analysed by Nees v. Esenbeck,[1] who found *Tannic Acid* 36 to 40 per cent.; *Peculiar Matter, Gum* or *Gummy Extractive, Tannic Deposit* (similar to red cinchonic), and 2½ per cent. of *Woody Fibre.*

1. TANNIC ACID.—The properties of this acid have been before described. That extracted from Gambir is soluble in water, alcohol, and ether, and gives a green colour to the salts of iron.

2. CATECHINE; *Catechuic Acid; Tanningensäure*, Buchner; *Resinous Tannin*, Nees.—When Gambir is treated with cold water, an insoluble residuum is left; this is *impure catechine*, and was termed by Nees, *Resinous Tannin.* When obtained quite pure, it is a white, light powder, composed of silky needles, having a peculiar sweet taste. It is very slightly soluble only in cold water, more so in boiling water. Ether, and especially alcohol, are better solvents for it. It produces a green colour with salts of iron, but does not produce a precipitate with a gelatinous solution. Its composition is $C^{15}H^{6}O^{6}$. If it be digested in caustic potash, and the solution exposed to the air, oxygen is absorbed, and the catechuic acid is converted into *Japonic Acid*, composed of $C^{12}H^{4}O^{4}$. But if it be dissolved in carbonate of potash, and exposed to the air without heat, it is converted into *Rubinic Acid*, composed of $C^{24}H^{8}O^{8}$.

PHYSIOLOGICAL EFFECTS.—Gambir is one of the most powerful of the *pure astringents*, whose effects have been before described. Its sweet taste depends, in part at least, on catechuic acid.

USES.—It is employed by druggists as catechu (see *Acacia Catechu*).

OTHER MEDICINAL RUBIACEÆ.

[GALIUM APARINE—known under the common name of Goose Grass or Cleavers,—was long since described by Murray, as possessing antiscorbutic properties. Wibmer refers to it in his Arzneimittelehre as a plant full of a watery, acrid, inodorous juice having a bitter taste; and he says that its medicinal properties are very slight. The attention of the profession was specially called to the use of this plant by Dr. Winn of Truro, in 1851.[2] It had been introduced into that county by a German quack, as a remedy for Lepra, and it had acquired some popular repute. Dr. Winn speaks of its efficacy in one case which fell under his observation. He employed it in the form of decoction by boiling a handful of leaves in a quart of water for about twenty minutes. Of this decoction he gave three parts daily. He has since found the inspissated juice, or concentrated fluid extract, to act more rapidly and effectually than the decoction. A teaspoonful of the extract is considered to be equal to half a pint of the decoction. Dr. Winn finds that a drachm taken three times a day is sufficient for ordinary cases. We are farther informed, that he has found it to be a useful remedy in various cutaneous diseases, among others in a case of *lichen circumscriptus* which had resisted other treatment. It acts as a mild diuretic.

[*G. Aparine*, L.—*Leaves* 6–8, in a whorl, lanceolate, hispid, margins midrib, and angles of the stem very rough, with reflexed bristles, peduncles axillary, stem weak, fruit hispid.

[An annual plant abundant in hedges and straggling among bushes. *Flowers* few, two or three together, on short simple footstalks, arising from the axils of the leaves. *Bristles* of the *fruit* hooked, which by their means catches hold of the coats of animals and is widely dispersed. The seeds have been recommended as a substitute for coffee. Schwartz states, that he has found in the decoction of galium—citric acid, rubichloric acid, and another acid which be calls galitannic. The formula of the latter he gives as $C_{14} H_{4} O_{10} + HO$.[3]—ED.]

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[1] *Pharm. Centr.-Blatt für* 1830, 45.

[2] See *Medical Gazette*, vol. xlviii. p. 606.

[3] See *Pharmaceutical Journal*, Oct. 1852, p. 190.—ED.

ORDER LVII. CAPRIFOLIACEÆ, *Jussieu.*—THE HONEYSUCKLE TRIBE.

CHARACTERS.—*Calyx* superior, 4- or 5-cleft, usually with 2 or more bracts at its base. *Corolla* superior, monopetalous or polypetalous, rotate or tubular, regular or irregular. *Stamens* epipetalous, equal in number to the lobes of the corolla, and alternate with them. *Ovary* with from 1 to 3 or 4 cells, one of which is often monospermous, the others polyspermous: in the former the ovule is pendulous; *style* 1; *stigmas* 1, or 3 to 4. *Fruit* indehiscent, 1- or more-celled, either dry, fleshy, or succulent, crowned by the persistent lobes of the calyx. *Seeds* either solitary and pendulous, or numerous and attached to the axis; *testa* often long; *embryo* straight, in fleshy albumen; *radicle* next the hilum.—*Shrubs* or *herbaceous* plants, with opposite *leaves*, destitute of *stipules*. *Flowers* usually corymbose, and often sweet-scented (Lindley).

PROPERTIES.—Not uniform.

241. SAMBUCUS NIGRA, *Linn.*—COMMON ELDER.

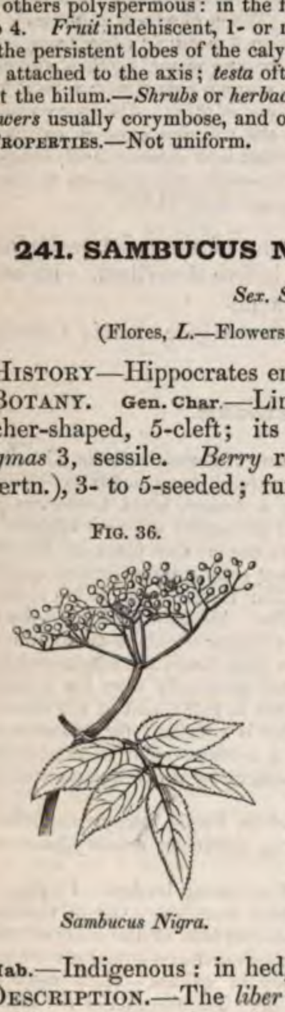
Sex. Syst. Pentandria Trigynia.

(Flores, *L.*—Flowers, *E.*—Flores, Baccæ, Cortex interior, *D.*)

HISTORY—Hippocrates employed the elder (ἀκτῆ) in medicine.

BOTANY. **Gen. Char.**—Limb of the *calyx* small, 5-cleft. *Corolla* rotate pitcher-shaped, 5-cleft; its lobes obtuse. *Stamens* 5. *Style* none. *Stigmas* 3, sessile. *Berry* roundish, scarcely crowned, pulpy, 1-celled (Gærtn.), 3- to 5-seeded; funiculi bearing the oblong seeds in the axis of the fruit (De Cand.)

FIG. 36.



Sambucus Nigra.

Sp. Char.—*Stem* shrubby, somewhat arboreous. *Leaves* pinnatisect, smooth; segments ovate-lanceolate, serrate. *Corymbs* 5-partite (De Cand.)

Stem much and irregularly (though always oppositely) branched, of quick growth; *branches* (after a year's growth) clothed with smooth grey bark, and filled with a light spongy pith. *Leaflets* deep green, smooth, usually 2-pair, with an odd one. *Cymes* [corymbs] large, smooth, of numerous cream-coloured *flowers*, with a sweet but faint smell; some in each cyme sessile. *Berries* globular, purplish-black; their stalks reddish (Smith).

Hab.—Indigenous: in hedges, coppices, and woods; common.

DESCRIPTION.—The *liber* or *inner bark* (*cortex interior sambuci*) is collected from the branches: its colour is greenish-white; its taste sweetish astringent; its odour feeble. Its infusion is rendered slightly green by the sesquichloride of iron. *Elder flowers* (*flores sambuci*) are white when fresh, but by drying become yellow, and retain an agreeable odour. *Elder berries* (*baccæ sambuci*) yield, by expression, a purple juice, called *elder rob*.

COMPOSITION.—I am unacquainted with any analysis of *elder bark*.[1] The *flowers* were analysed by Eliason,[2] who obtained from them *volatile oil, acrid resin, tannic acid, oxidised extractive, nitrogenous extractive, gum, woody fibre, glutinous matter, albumen, malates of potash and lime, mineral salts*, and a trace of *sulphur*. *Elder juice* contains *malic acid*, a little *citric acid, sugar, pectin*, and *colouring matter*, which is reddened by acids, and made green by alkalies.

PHYSIOLOGICAL EFFECTS.—The *flowers*, owing to their volatile oil, are mildly stimulant, and, perhaps, sudorific. The *berries* are cooling, aperient, and diuretic. The *inner bark* (liber) is hydragogue, cathartic, and emetic. The *leaves*, probably, possess similar, though less energetic, properties.

USES.—The *flowers* are seldom employed, except in the preparation of *elder-flower water* and *elder ointment*. The use of the *berries* is now almost solely confined to the manufacture of *elder wine*. The *inspissated juice* of the berries is, however, an officinal preparation. The *inner bark* has been used as a hydragogue cathartic in dropsy. It may be given in decoction (prepared by boiling ℥j. of the bark in Oij. of water to Oj.), in doses of f℥iv. Smaller doses have been used as an aperient and resolvent in various chronic disorders [and Borgelli has recently published 5 cases of epilepsy which appeared to be cured by the administration of the infusion of the bark.[3]—ED.]

1. **AQUA SAMBUCI**, L. E.; *Elder Water*. (Elder Flowers [fresh], lb. x.; Water, *Conj.* ij.; Rectified Spirit, f℥iij. *E.* Mix them, and let a gallon distil.)—Elder water is frequently made from the *pickled flowers* (*flores sambuci saliti*) which are prepared with alternate layers of the flowers and common salt compressed and preserved in a well-closed vessel [usually a cask]: the water which exudes being rejected. It is principally used as a perfume.

2. **UNGUENTUM SAMBUCI**, L.; *Elder Ointment* (Elder Flowers, Lard, of each lb. j. Boil the Elder Flowers in the Lard until they become crisp; then press through a linen cloth.)—The *Unguentum Sambuci*, Ph. L., is the *white elder ointment* of the shops. Except in its agreeable odour it has no advantage over spermaceti ointment. It is popularly used as a cooling application to irritable surfaces.

ORDER LVIII. ARALIACEÆ, *Richard*.—THE ARALIA TRIBE.

ARALIÆ, *Jussieu*.

242. Panax quinquefolium.—Ginseng.

1. PANAX QUINQUEFOLIUM, Linn., is a native of North America, growing in the Northern, Middle, and Western States of the Union. Its root is the *American*

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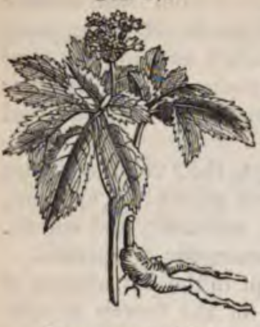
[1] Simon has analysed the bark of the root, and states that its active principle is a soft uncrystallisable resin. Twenty grains of the alcoholic extract of the bark produced vomiting four or five times, and as many stools (*Journal de Pharmacie*, 1840, p. 247).

[2] Gmelin, *Handb. d. Chem.* ii. 1279.

[3] *Annuaire de Therapeutique*, p. 134, 1855.

FIG. 37.



Panax quinquefolium.

Ginseng (*radix ginseng*). It is exported to China, where it is highly valued. Pieces of it are said to be occasionally found intermixed with *senega root.*

2. PANAX SCHINSENG, Nees v. Esenbeck, is a native of Asia, and has been usually confounded with the preceding species. Nees admits three varieties:—*P. Schin-seng*, var. *coraiensis; P. Schin-seng*, var. *japonica;* and *P. Schin-seng*, var. *nepalensis* (*P. Pseudo-ginseng*, Wallich). The root of this species is the *Asiatic Ginseng* (*radix ninsi.*)

The Chinese physicians ascribe the most improbable and extravagant virtues to ginseng. They regard it as an invigorating and aphrodisiac agent. At Pekin it is said to have been sometimes worth its weight in gold! To the taste it is mucilaginous, sweetish, somewhat bitter, and slightly aromatic. In Europe it is believed to possess very little power.

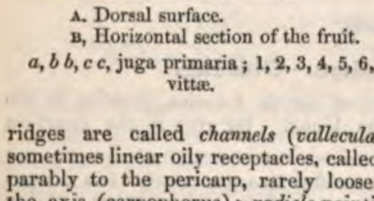
ORDER LIX. UMBELLIFERÆ, *Jussieu.*—THE UMBELLIFEROUS TRIBE.

APIACEÆ, *Lindley.*

DIAGNOSIS.—Polypetalous dicotyledons, with definite perigynous stamens, concrete carpella, an inferior ovarium of several cells, pendulous solitary ovula, leaves sheathing at the base, umbellate flowers, embryo at the base of fleshy albumen.

CHARACTERS.—Tube of the *calyx* adherent to the ovary; the limb [superior calyx of *Lindley*] entire, or 5-toothed, or obsolete. *Petals* 5, inserted into the upper part of the calyx [inserted on the outside of a fleshy epigynous disc, *Lindley*], usually inflexed at the point: æstivation imbricate, rarely valvate. *Stamens* 5, alternate with the petals, incurved in æstivation. *Ovary* [inferior, *Lindley*] adherent to the calyx, 2- (rarely 1-) celled, with solitary pendulous ovules: *styles* 2, distinct, incrassated at the base into *stylopodia*, covering the whole of the ovarium; *stigmas* simple. *Fruit* (called *diachæna, polyachæna*, or *cremocarpium* (from κρεμαω *I suspend*, and καρπος *fruit*), consisting of two *mericarps* (from μερίς *a part*) (i. e. 2 carpella, with half of the calyx attached, so that they can be called neither *carpella* nor *achenia*), separable from a common axis (*carpophorus* from καρπος *fruit*, and φορέω *I bear*), to which they adhere by their face (*commissure*); the dorsal surface of each carpel is traversed by *ridges*, of which 5 are primary (*costæ* seu *juga primaria*), and 4 secondary (*juga secundaria*); the latter are sometimes absent: the spaces between the ridges are called *channels* (*valleculæ*). In the channels, within the pericarp, are sometimes linear oily receptacles, called *vittæ*. *Seed* pendulous, usually adhering inseparably to the pericarp, rarely loose: *embryo* minute, pendulous from the apex of the axis (carpophorus); *radicle* pointing to the hilum; *albumen* abundant, horny, flat (*Orthospermæ*), or rolled inwards at the edges (*Campylospermæ*), or rarely curved inwards from the base to the apex (*Cœlospermæ*).—*Herbaceous* plants, with fistular furrowed *stems*. *Leaves* usually divided, sometimes simple, sheathing at the base.

FIG. 38.



Fruit of Pastinica saliva.

A. Dorsal surface.
B, Horizontal section of the fruit.
a, b b, c c, juga primaria; 1, 2, 3, 4, 5, 6, vittæ.

Flowers in umbels, white, pink, yellow, or blue, generally surrounded by an *involucre* (condensed from De Candolle).

PROPERTIES.— Extremely variable.

The Umbelliferæ may be thus arranged:—

1. *Umbelliferous carminative fruits used in medicine:*—
    - Caraway.
    - Anise.
    - Fennel.
    - Angelica.
    - Dill.
    - Cumin.
    - Carrot.
    - Coriander.
    - Fœnugreek.
2. *Umbelliferous roots used in medicine:*—
    - Angelica.
    - Carrot.
3. *Umbelliferous fœtid gum resins:*—
    - Assafœtida.
    - Sagapenum.
    - Galbanum.
    - Ammoniacum.
    - Opoponax.
4. *Narcotic umbelliferæ:*—
    - Conium.

1. UMBELLIFEROUS AROMATIC OR CARMINATIVE FRUITS.

Vittæ.—These are not present in all umbelliferous fruits. They exist, however, in all the fruits now under consideration. In fact, these fruits owe their aromatic and carminative qualities to the oil contained in these vittæ.

a. In general the *vittæ* are found in the *channels* or *valleculæ;* and in some cases there is only one,—in others there are more than one vitta in each channel. Sometimes there are vittæ also at the commissure.

> Ex.—*Univittate* channels: (bivittate commissure) *Caraway; Fœniculum; Anethum; Cumin; Carrot.*
>
> Ex.—*Multivittate* channels: *Anise.*

b. In some cases, however, the *vittæ* are not found in the channels, but in the *commissure* only.

> Ex.—*Coriander:* commissure bivittate.

The contents of these vittæ is an *oleo-resinous juice.* It is usually deeply coloured. Probably primitively it is oil (volatile) which has become resinified by the air.

Volatile oil.—When the fruits are submitted to distillation with water, the volatile oil comes over with the water.

The quantity obtained varies with the fruit and a variety of circumstances. In a general way, we may say 4 or 5 per cent. is the amount.

It is probable that in all cases there are two oils obtained from the fruit; one a pure *hydrocarbon,*—the other an *oxhydrocarbon.* At least, in a few cases, by re-distilling the oil with caustic potash, we obtain a pure hydrocarbon. In the case of caraway oil, this hydrocarbon (*carum*) has for its formula $C^{10}H^{8}$. In the case of cumin, it (*cumen*) has a formula $C^{18}H^{24}$.

The *oxhydrocarbonaceous* oil is probably an acid formed by the union of the *hydrocarbon* with atmospheric oxygen. A still higher oxidation probably furnishes a resin. The agency of the potash, in the distillation, is to fix the acid by combining with it: the non-acid or pure hydrocarbon then distils over.

Dissolved in alcohol we obtain the so-called *spirits* (as of *caraway, anise,* &c.) Besides the pharmaceutical preparations of this kind, there are analogous ones sold by the spirit dealer under the name of *compounds* or *British liqueurs* (as aniseed, caraway, &c.) These are weaker than the pharmaceutical spirits, and sweetened.

Diffused through or slightly dissolved in water, these oils impregnate the water with their odour, and to a certain extent with their medicinal properties. *Caraway, dill, anise,* and other waters, are examples.

Of the properties of the oils individually some remarks will be made hereafter. Those which are subject to fraud or substitution, accidental or purposed, especially deserve notice.

1. OIL OF FENNEL.—There are two varieties—the *oil of sweet fennel* and the *oil of wild fennel.* The London College orders *sweet fennel.* The *Edinburgh College* adopts

Fœniculum officinale. Now this by botanists is usually regarded as only a variety, perhaps, of the *wild fennel.* Christison says the seed is found among nurserymen as *Florence seed.*

2. OIL OF ANISE.—I notice this for the purpose of mentioning that *oil of star-anise* is frequently substituted for it. I know of no ill-consequences likely to result therefrom: one oil is probably as good as another. Still, as there is a difference in price, the substitution of one for the other is a fraud.

Respecting *caraway, dill, cumin, angelica,* and *coriander* fruits (called seeds), I have nothing particular to remark. *Carrot* fruit deserves notice for its structure (see *Daucus Carota.*)

243. CARUM CARUI, *Linn.*—COMMON CARAWAY.

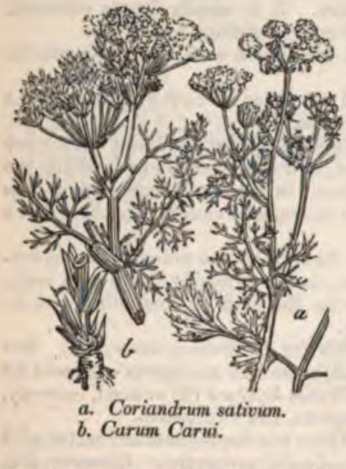
Sex. Syst. Pentandria Digynia.

(Fructus, *L.*—Fruit, *E.*—Semina, *D.*)

HISTORY.—Caraway is not mentioned in the writings attributed to Hippocrates. Pliny[1] and Dioscorides[2], however, speak of it: the former calls it *Careum* (from Caria, its native country),—the latter terms it κάρος.

BOTANY. **Gen. Char.**—Margin of the *calyx* obsolete. *Petals* regular, obovate, emarginate, with an inflex lobe. *Stylopodium* depressed. *Styles* deflexed. *Fruit* contracted at the side, ovate, or oblong. *Mericarps* [half-fruits] with five equal filiform ridges, the lateral ones marginal. *Commissure* flat, bivittate. *Channels* 1-vittate. *Carpophorus* free, forked at the apex. *Seeds* terete-convex, flat in front.—Smooth often perennial *herbs. Root* tuberous, edible. *Leaves* pinnatisect; the segments many-cleft. *Involucre* variable. *Flowers* white (De Cand.)

FIG. 39.



a. Coriandrum sativum.
b. Carum Carui.

Sp. Char.—*Root* fusiform. *Leaves* bipinnatisect; the lower segments of the branches decussate, all many-cleft. *Involucre* none (De Cand.)

Biennial. Stem branched, about 2 feet high. *Umbels* numerous, dense. *Flowers* white or pale flesh-coloured; appear in June.

Hab.—In meadows and pastures all over Europe; naturalised in England. Largely cultivated in Essex.

DESCRIPTION.—The mericarps, commonly called *caraway seeds* (*fructus seu semina carui*) are from 1½ to 2 lines long, usually separated, slightly curved inwards, of a brownish colour, with five lighter coloured primary ridges; there are no secondary ones. In each channel is one vitta, and on the commissure are two. The smell is aromatic and peculiar, the taste warm and spicy. The caraway of the shops is in part the produce of this country, but is partly supplied from Germany. In 1839, duty (30s. per cwt.) was paid on 515 cwts. which were imported.

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[1] *Hist. Nat.* lib. xix. cap. 49, ed. Valp.

[2] Lib. iii. cap. 66.

COMPOSITION.—No analysis of the fruit has been made. The aromatic qualities depend on a volatile oil. (See below.)

PHYSIOLOGICAL EFFECTS.—Caraway is an aromatic stimulant and condiment. Its effects are similar to those of dill and anise.

USES.—Caraway is principally consumed by the confectioner and cook. It is also used by the distiller for flavouring liqueurs. Its medicinal employment is not extensive. It is given to relieve the flatulent colic of children, and enters, as an adjuvant or corrective, into several officinal compounds. It is less seldom employed in substance than in the form of *oil*, *spirit*, or *water*.

1. **OLEUM CARUI**, L. E. D.; *Oil of Caraway.* (Obtained by submitting the fruit [bruised, *E.*] to distillation with water.)—The quantity obtained from a given weight of fruit is variable; Recluz says about 4·7 per cent.; but I am informed, by a manufacturing chemist, that he has obtained 213 lbs. of oil from 35 cwts. of the fruit; which is about 5·43 per cent. When fresh prepared it is colourless; but it becomes yellow and subsequently brown by keeping. It is limpid, and has the aromatic odour of the fruit and an acrid taste. Its sp. gr. is 0·950 (0·938 *P. L.*) According to Schweizer,[1] it consists of *carbon* 86·14, *hydrogen* 10·68, and *oxygen* 3·18. When submitted to distillation with caustic potash, it yields a carbo-hydrogen (*caruen*) whose formula is $C^{10}H^{8}$. The brown residue in the retort yields, when mixed with water, a brown resin and a brown alkaline solution. If the latter be saturated with an acid and distilled, an acrid oil (*caruacrol*) is obtained. Oil of caraway is generally employed in the preparation of the *spirit* and *water*. It is used to impart flavour, to correct the nauseating and griping qualities of some medicines, and to relieve flatulence. It is frequently added to cathartic pills and powders. —Dose, one to ten drops.

[2. **SPIRITUS CARUI**, L. E.; *Spirit of Caraway.* (Oil of Caraway, fʒij. [Bruised Caraway, lb. ss. *E.*]; Proof Spirit, *Cong.* j. [Ovij. *E.*] Mix. [Water, Ojss. *E.*] Macerate for two days in a covered vessel, *E.*; distil off lb. vij. *E.*, by a gentle heat. The simple solution of the oil, as recommended by the London College, is by far the best mode of preparing this and the other spirits of the Pharmacopœia.—ED.] It is aromatic and carminative. Dose, fʒj. to fʒiv. Sweetened with sugar, this spirit is drunk in Germany as a dram (*Kümelliqueur; Kumelbrandtwein*).

3. **AQUA CARUI**, L. D.; *Caraway Water.* (Caraway Oil, fʒij.; Powdered Flint, ʒij.; Distilled Water, *Cong.* j. Beat up the oil thoroughly first with the flint, afterwards with the water, and filter the liquor, *L.* Essence of Caraway, ℥j.; Distilled Water, ℥ix. Mix with agitation, and filter through paper, *D.*)—This water is employed as a carminative vehicle for purgatives (as saline purgatives, magnesia, &c.) and in the flatulent colic of children.

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[1] *Pharmaceutisches Central-Blatt für* 1841, S. 789.

244. PIMPINELLA ANISUM, *Linn.*—THE ANISE.

Sex. Syst. Pentandria Digynia.

(Fructus, *L.*—Fruit, *E.*—Semina, *D.*)

HISTORY.—Anise was used by Hippocrates.[1] It is also mentioned by Pliny[2] and Dioscorides.[3] The latter terms it ἄνισον. It was introduced into this country in 1551. In our translation of the New Testament,[4] the word *anise* occurs instead of *dill*.

BOTANY. **Gen. Char.**—Margin of the *calyx* obsolete. *Petals* obovate, emarginate, with an inflexed lobe. *Fruit* contracted at the side, ovate, crowned by a cushion-like disk, and reflexed, somewhat capitate styles. *Mericarps* [half-fruits] with five, filiform, equal ridges, the lateral ones being marginal. *Channels* multivittate, with a bifid free carpophorus. *Seed* gibbous convex, anteriorly flattish. *Roots* simple, radical *leaves* pinnatisect; the segments roundish, toothed, rarely undivided; those of the stem more finely cut. *Umbels* of many rays. *Involucre* none. *Petals* white, rarely pink or yellow (De Cand.)

Sp. Char.—*Stem* smooth. Radical *leaves* cordate, somewhat roundish, lobed, incised, serrate; middle ones pinnate lobed, the lobes cuneate or lanceolate; the upper ones trifid, undivided, linear. *Fruit* bearing a few scattered hairs (De Cand.)

Root tapering. *Stem* erect, branched, about a foot high. *Flowers* small, white.

Hab.—Island of Scio and Egypt. Largely cultivated for its fruit in Malta, Spain, and various parts of Germany. It also grows in Asia.

DESCRIPTION.—The fruit, called *aniseed* (*fructus* seu *semina anisi*), is slightly compressed at the sides. The separated mericarps are ovate, of a greyish-green colour, with five paler, thin, filiform, primary ridges (there are no secondary ones), and covered with downy hairs. In each channel are three vittæ. The odour is aromatic, and similar to that of the fruit of *Illicium anisatum*, or *star anise*, a plant belonging to the family Winteraceæ. The taste is sweetish and aromatic. By careless observers, aniseed may be confounded with the fruit of hemlock.

COMMERCE.—Aniseed is principally imported from Alicant and Germany (the first is preferred); but some is also brought from the East Indies. In 1839, duty (5s. per cwt.) was paid on 192 cwts.

COMPOSITION.—A very elaborate analysis of the fruit was made by Brandes and Reimann in 1826.[5] The following are their results:—*Volatile oil* 3·00, *stearin combined with chlorophylle* 0·12, *resin* 0·58, *fatty oil* soluble in alcohol 3·38, *phytocol* 7·85, *incrystallisable sugar* 0·65, *gum* 6·50, *extractive* 0·50, *substance analogous to ulmin* (Anis-ulmin) 8·60, *gumoin* 2·90, *lignin* 32·85, *salts* (acetate, malate, phosphate, and sulphate)

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[1] Pp. 263, 265, &c. ed. Fœs.
[2] *Hist. Nat.* lib. xx. cap. 72, ed. Valp.
[3] Lib. iii. cap. 65.
[4] *Matth.* xxiii. 23.
[5] Gmelin, *Handb. d. Chem.* ii. 1277.

of lime and potash 8·17, *inorganic salts, with silicic acid and oxide of iron* 3·55, *water* 23·00 (excess 1·65).

OIL OF ANISE (see below).

PHYSIOLOGICAL EFFECTS.—Anise is an aromatic stimulant. Its effects are similar to those of dill. The odour of anise is said to be recognised in the milk of those who have taken it: moreover, the urine, we are told, acquires an unpleasant smell from it: hence it would appear that the oil of anise becomes absorbed. It has been supposed to promote the secretion of milk, urine, bronchial mucus, and of the menses, though without sufficient evidence. Vogel[1] says that he accidentally discovered that pigeons are readily killed by a few drops of the oleum anisi. Hillefield[2] also notices its poisonous operation on pigeons.

USES.—Anise is used to flavour liqueurs, sweetmeats, confectionary of various kinds, ragouts, &c.

In medicine it is employed to relieve flatulence and colicky pains, especially of children, and to prevent the griping effects of some cathartics. Nurses sometimes take it to promote the secretion of milk. It has also been employed in pulmonary affections. It is used as a horse medicine.

1. OLEUM ANISI, L. E. D.; *Oil of Anise.* (Obtained by submitting the fruit with water to distillation.)—Mr. Brande says, that from one cwt. of fruit about two pounds of oil are obtained. The greater part of the oil consumed in this country is foreign. The oil of anise of the shops is imported into this country chiefly from the East Indies. In 1839, duty (1s. 4d. per lb.) was paid on 1544 lbs. It is procured, by distillation, from the fruit, in whose pericarp it resides. When carefully prepared it is transparent and nearly colourless, having a slightly yellow tinge. It has the odour and taste of the fruit from which it is obtained. Its specific gravity increases with its age: thus Martius says, that when the oil is fresh distilled, the specific gravity is only 0·979; but after keeping it for a year and a half, the specific gravity had increased to 0·9853. It congeals at 50° F., and does not liquefy again under 62°. It is soluble in all proportions in alcohol; but spirit, whose specific gravity is 0·84, dissolves only 0·42 of its weight. By exposure to the air it forms resin, and becomes less disposed to concrete. It is composed of two volatile oils,—one solid at ordinary temperatures (*stearoptène*); the other liquid (*eleoptène*),—in the following proportions:—eleoptene 75, stearoptene 25. According to Cahours, the stearoptene consists of $C^{20}H^{12}O^{2}$.

The *oleum badiani*, or the *oil of star anise* (*Illicium anisatum*), has the odour and taste of the oil of anise; but it preserves its fluidity at 35·6 F. It is sometimes fraudulently substituted for the *oleum anisi.*

[We are assured, however, on the authority of a well-known dealer, that the common oil of aniseed is hardly ever seen in commerce, either in England or on the Continent. In this country it has given place to the oil imported from India, which is without exception star aniseed oil from China. This is purer in odour and taste than the common German oil, and is sold under the general name of aniseed oil. The duty is now one shilling per pound, and there is no doubt that the 1544 lbs. referred to by the author as duty paid and imported in 1839, was East India or star aniseed oil. The quantities of aniseed oil (star aniseed) on which duty was paid in four years amounted to

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[1] *Hist. Mat. Med.* 161.

[2] Wibmer, *Wirk. d. Arzneim.* Bd. ix. S. 207.

	POUNDS.		POUNDS.
In 1841	1301	In 1843	1719
1842	2664	1844	2475 ED.]

ADULTERATIONS.—Spermaceti, which is said to be sometimes added to oil of anise, to promote its solidification, may be distinguished by its insolubility in cold alcohol. Camphor, said to be added for the same purpose, is recognised by its odour.—Dose, five to fifteen drops on sugar, or rubbed up with sugar in camphor mixture.

2. **SPIRITUS ANISI**, L.; *Spirit of Anise.* (Oil of Anise, fʒiij.; Proof Spirit, *Conj.* j. Dissolve.)—Stimulant, stomachic, and carminative. Dr. Montgomery[1] says that the preparation under this name formerly in the Dublin Pharmacopœia had nearly the composition of the Irish *Usquebaugh*, which is coloured yellow by saffron, or green by sap-green. A spirit of anise, sweetened with sugar, is sold by the liqueur dealers. A somewhat similar compound is prepared in France under the name of *crême d'anise.* —Dose, fʒj. to fʒiv.

3. **AQUA ANISI**, D.; *Anise Water.* (Extemporaneously made by diffusing the oil through water by the aid of sugar or spirit; or, according to the Dublin formula, by mixing ℥j. of the oil with half a gallon of water, and filtering.)—Employed to relieve flatulent colic of infants, and as a vehicle for other medicines.

245. FŒNICULUM VULGARE, *Gært.*—COMMON FENNEL.

Fœniculum officinale, *E.*

Sex. Syst. Pentandria Monogynia.

HISTORY.—Fennel (*μάραθρον*) was used by Hippocrates.[2] Some botanists (e. g. Matthiolus) have been of opinion that the *μάραθρον* of Dioscorides[3] is *sweet fennel* (*Fœniculum dulce*, De Cand.), and that the *ἱππομάραθρον* of the same authority[4] is *common fennel* (*Fœniculum vulgare*, De Cand.); but the latter part of the opinion, from an observation of Bauhn[5] does not appear probable.[6]

BOTANY. **Gen. Char.**—Margin of the *calyx* swollen, obsolete, toothless. *Petals* roundish, entire, involute, with a squarish, blunt lobe. *Fruit* by a transverse section nearly taper. *Mericarps* [half-fruits] with five prominent, bluntly-keeled ridges, of which the lateral ones are marginal and

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[1] *Observ. on the Dubl. Pharm.*

[2] P. 551, &c. ed. Fœs.

[3] Lib. iii. cap. 81.

[4] Lib. iii. cap. 82.

[5] *Prodromus*, p. 76.

[6] Dierbach, *Arzneim. d. Hippocr.* 191.

rather broader. *Channels* univittate. *Commissure* bivittate. *Seed* nearly semiterete. — Biennial or perennial *herbs*. *Stems* taper, somewhat striated, branched. *Leaves* pinnatisect, decompound; the segments linear, setaceous. *Involucre* scarcely any. *Flowers* yellow (De Cand.)

Sp. Char.—*Stem* somewhat terete at the base. Lobes of the *leaves* linear, subulate, elongated. *Umbels* of 13 to 20 rays. *Involucre* none (De Cand.)

A biennial, three or four feet high. *Flowers* golden yellow. *Fruit* scarcely two lines long, oval, of a dark or blackish aspect; the channel is brownish owing to the vitta, the ridges are pale yellowish grey.

Hab.—Sandy and chalky ground all over Europe.

DESCRIPTION.—The fruit, called *wild fennel seed* (*semina* seu *fructus fœniculi vulgaris*) has a strong aromatic, acrid taste, and an aromatic odour. Its other qualities have been described.

COMPOSITION.—The peculiar properties of the fruit depend on a *volatile oil*.

OIL OF COMMON, WILD, OR BITTER FENNEL (*Oleum Fœniculi vulgaris*).—A pale yellow, limpid oil, having the peculiar odour of the fruit. Its sp. gr. is 0·997. It congeals by a cold below 50°, though with much more difficulty than oil of anise. It consists of a stearoptène which has the same composition as that of oil of anise; and a liquid oil which is isomeric with oil of turpentine. [The formula of oil of fennel is $C^{20}H^{12}O^{2}$.—ED.]

PHYSIOLOGICAL EFFECTS.—Aromatic stimulant, similar to those of sweet fennel.

USES.—This species is not employed in medicine.

246. FŒNICULUM DULCE, *C. Bauhin; De Cand.*—SWEET FENNEL.

Sex. Syst. Pentandria Monogynia.

(Fructus, *L.*)

HISTORY.—This plant is regarded by some botanists as a cultivated variety of the former plant. De Candolle[4] is the principal systematic writer who regards them as distinct species.

BOTANY. **Gen. Char.**—See *F. vulgare*.

Sp. Char.—*Stem* somewhat compressed at the base. Radical *leaves* somewhat distichous; lobes capillary, elongated. *Umbels* of six to eight rays (De Cand.)

This plant differs from *F. vulgare* in several other particulars. It is an annual and much smaller plant. It flowers earlier. Its turiones are sweeter, less aromatic, and therefore edible. The fruit is much longer; some of the specimens being nearly five lines in length, less compressed, somewhat curved and paler, with a greenish tinge.

Hab.—Italy, Portugal, &c. Cultivated as a pot-herb, and for garnishing.

DESCRIPTION.—The fruit, termed *sweet fennel seeds* (*fructus* seu *semina fœniculi dulcis* vel *fœniculi cretici*) has a more agreeable odour and flavour

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[1] *Prodr.* iv. 142.

than common or wild fennel. Two kinds are known in trade, *shorts* and *longs:* the latter is most esteemed.

Composition.—The peculiar properties of the fruit depend on a volatile oil.

Physiological Effects.—Sweet fennel is an aromatic stimulant; its effects are similar to those of anise or dill.

Uses.—Seldom employed. May be given in the flatulent colic of children, or as a carminative vehicle for remedies which are apt to gripe.

1. OLEUM FŒNICULI, L. E. D.; *Oil of Sweet Fennel; Oleum Fœniculi dulcis.* (Obtained by submitting the fruit [bruised, *E.*] with water to distillation.)—Nineteen cwts. of the fruit (*shorts*) yield 78 lbs. of oil.[1] This oil is distinguished from the oil of wild fennel by its more agreeable odour and taste. Stimulant and carminative. Seldom used.—Dose, two to twenty drops.

2. AQUA FŒNICULI, E. D.; *Fennel Water.* (Obtained like *Aqua Anethi*, see p. 167.)—Carminative. Employed to relieve flatulent colic of infants, and as a vehicle for other medicines.—Dose, for an adult, f℥j. to f℥iij.; for an infant, fʒj. to fʒij.

247. ANETHUM GRAVEOLENS, *Linn.*—COMMON GARDEN DILL.

Sex. Syst. Pentandria Digynia.

(Fructus, *L.*—Fruit, *E.*)

History.—This plant is mentioned by Hippocrates,[2] by Dioscorides,[3] and by Pliny.[4] It is also noticed in the New Testament.[5]

Botany. **Gen. Char.**—Margin of the *calyx* obsolete. *Petals* roundish, entire, involute, with a squarish retuse lobe. *Fruit* lenticular, flattened from the back, surrounded by a flattened border. *Mericarps* [half-fruits] with equidistant, filiform ridges; the three intermediate [dorsal] acutely keeled, the two lateral more obsolete, losing themselves in the border. *Vittæ* broad, solitary in the channels, the whole of which they fill, two on the commissure. *Seeds* slightly convex, flat in front.—Smooth erect *annuals. Leaves* decompound, with setaceous linear lobes. *Involucre* and *involucellæ* none. *Flowers* yellow (De Cand.)

Sp. Char.—*Fruit* elliptical, surrounded with flat dilated margin (De Cand.)

Root tapering long. *Stem* one and a half to two feet high, finely striated, simply branched. *Leaves* tripinnated; segments fine capillary; leaf-stalks broad and sheathing at the base. The plant greatly resembles common fennel, though its odour is less agreeable.

Hab.—South of Europe, Astrachan, Egypt, Cape of Good Hope, Timor, &c. Probably migratory. Cultivated in England.

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[1] Private information.

[2] *Opera*, p. 359, ed. Fœs.

[3] Lib. iii. cap. 67.

[4] *Hist. Nat.* lib. xx. cap. 74, ed. Valp.

[5] *Matt.* xxiii. 23.

DESCRIPTION.—The fruit, commonly called *dill seed* (*fructus* seu *semina anethi*) is oval, flat, dorsally compressed, about a line and a half long, and from half to one line broad, brown and surrounded by a lighter-coloured membranous margin (*ala*). Each mericarp or (half-fruit) has five primary ridges, but no secondary ones. In each channel is one vitta, and on the commissure are two vittæ. These vittæ contain the aromatic oil. The odour of the fruit is strongly aromatic; the taste warm and pungent.

COMPOSITION.—Dill owes its peculiar properties to a volatile oil. (See below.)

PHYSIOLOGICAL EFFECTS.—Aromatic stimulant, carminative and condimentary, analogous to other aromatic umbelliferous fruits.

USES.—Employed as a condiment by the Cossacks. Loudon[1] says the leaves "are used to heighten the relish of some vegetable pickles, particularly cucumbers; and also occasionally in soups and pickles."

In medicine it is principally employed in the diseases of children. It is a common domestic remedy among nurses, to relieve flatulence and griping of infants. Occasionally it is taken under the idea of its promoting the secretion of milk. Practitioners generally use dill as a vehicle for the exhibition of purgative and other medicines to children, the griping of which it assists in preventing. The whole fruits may be given to adults in doses of ten grains to a drachm.

1. **OLEUM ANETHI**, L.; *Oil of Dill.* (Obtained by submitting the bruised fruit of dill, with water, to distillation.)—Two cwts. of the fruit yield 8 lbs. 5 ozs. of oil.[2] This oil is pale yellow. Its sp. gr. is 0·881. Its odour is peculiar and penetrating, analogous to that of the fruit. Its taste is hot, but sweetish. Alcohol and ether readily dissolve it. According to Tietzmann, 1440 parts of water dissolve one part of this oil. Principally used to prepare dill water. May be taken in the dose of a few drops on sugar, or dissolved in spirit.

2. **AQUA ANETHI**, L. E.; *Dill Water.* (Dill, bruised, lb. iss. [℥xviij. *E.*]; Rectified Spirit, ℥iij. *E.*; Water, *Cong.* ij. Mix. Let a gallon distil. [*Vel*, Oil of Dill, fʒij; Powdered Flint, ʒij.; Distilled Water, *Cong.* j. Beat up the oil carefully first with the flint, afterwards with the water, and strain the liquor. According to the London Pharmacopœia it may be made like the Aqua Carui, by triturating the oil with powdered flint and filtering through paper.—ED.]—Carminative. Dose for adults, f℥j. to f℥iij.; for infants, fʒj. to fʒiij. It is generally given to infants with their food.)

248. CUMINUM CYMINUM, *Linn.*—THE OFFICINAL CUMIN.

Sex. Syst. Pentandria Digynia.
(Fructus, *L.*—Fruit, *E.*)

HISTORY.—This plant is mentioned in both the Old and New Testament,[1] and by Hippocrates,[2] Dioscorides,[3] and Pliny.[4] The Greeks call it κύμινον ἥμερον vel αιθιοπικὸν.

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[1] *Encyclopædia of Gardening.*

[2] Private information.

BOTANY. **Gen. Char.**—Teeth of the *calyx* 5, lanceolate, setaceous, unequal, persistent. *Petals* oblong, emarginate, erect, spreading, with an inflexed lobe. *Fruit* contracted at the side. *Mericarps* [half-fruits] with wingless ridges; the primary ones 5, filiform, minutely muricated, the laterals forming a border; the secondary ones 4, more prominent, and aculeate. *Channels* under the secondary ridges 1-vittate. *Carpophorus* bipartite. *Seed* somewhat concave anteriorly, on the back convex.—*Herbs.* *Leaves* many-cleft: lobes linear, setaceous. Leaflets of the *involucre* 2 to 4, simple or divided. *Involucellum* halved, 2- to 4-leaved, becoming reflexed. *Flowers* white or pink (De Cand.)

Sp. Char.—Lobes of the *leaves* linear, setaceous, and acute. *Umbel* 3- to 5-cleft. *Partial involucre* equalling the pubescent fruit (De Cand.)

Root annual. *Stem* slender, branched, about a foot high. *Leaves* filiform. *Flowers* white or reddish.

Hab.—Upper Egypt, Ethiopia. Extensively cultivated in Sicily and Malta.

DESCRIPTION.—The fruit commonly termed *cumin seeds* (*fructus* seu *semina cumini*), is larger than anise, and of a light-brown or greyish-yellow colour. It has some resemblance to, though it is larger than, caraway. Each mericarp has five primary ridges, which are filiform, and furnished with very fine prickles. The four secondary ridges are prominent and prickly. Under each of these is one vitta. The odour of the fruit is strong and aromatic. Both odour and taste are somewhat analogous to, but less agreeable than, caraway. Cumin is imported from Sicily and Malta. In 1839, duty (2s. per cwt.) was paid on 53 cwts.

COMPOSITION.—The peculiar properties of cumin reside in a volatile oil.

OIL OF CUMIN; *Oleum Cumini.*—Obtained by submitting the fruit to distillation with water. Sixteen cwts. of the fruit yield about 44 lbs. of oil. This oil, as usually met with, is pale yellow and limpid. Its smell is disagreeable; its taste very acrid. It consists of two oils, one a carbo-hydrogen, called *Cumen or Cymen*, $C^{18}H^{24}$; the other an oxygenated oil called *Hydruret of Cumyl*, $C^{20}H^{11}O^{2}+H$. *Cumyl* is an hypothetical base composed of $C^{20}H^{11}O^{2}$. When treated with caustic potash, oil of cumin yields *hydrated cuminic acid*, $C^{20}H^{11}O^{3}+Aq$. This is a crystallisable solid.

PHYSIOLOGICAL EFFECTS.—Cumin agrees with the other aromatic umbelliferous fruits in its mildly stimulant and carminative qualities.

USES.—Internally cumin is rarely used; caraway being an equally efficient and a much more agreeable medicine. As a discutient and resolvent, it is employed, externally, in the form of *plaster* (*Emplastrum cumini*, Ph. L. 1824) and *cataplasm* (*cataplasma e cymino*, Quincy). In the recent London Pharmacopœia the *Emplastrum Cumini* has been restored. The dose of cumin seeds is grs. xv. to ʒss. It is principally used in veterinary surgery.

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[1] *Isaiah*, xxviii. 27; *Matthew*, xxiii. 23.

[2] *Opera*, 407, &c. ed. Fœs.

[3] Lib. iii. cap. 68.

[4] *Hist. Nat.* lib. xix. cap. 47, ed. Valp.

[**EMPLASTRUM CUMINI**, L. (Cumin, Caraway, Laurel, each ℥iij.; Prepared Burgundy Pitch, lbs. iij.; Wax. ʒiij.; Olive Oil, Water, each f℥iss. Add the oil and water to the pitch and wax melted together and powdered dry, then evaporate to a proper consistence.)—This preparation was excluded from the Ph. L. of 1836, but is now restored.—ED.]

249. CORIANDRUM SATIVUM, *Linn.*—THE OFFICINAL CORIANDER.

Sex. Syst. Pentandria Digynia.
(Fructus, *L.*—Fruit, *E.*—Semina, *D.*)

HISTORY.—Coriander is mentioned by Moses.[1] It was used by Hippocrates.[2] Dioscorides[3] and Pliny[4] also mention it. The Greeks called it κόριον or κορίαννον.

BOTANY. **Gen. Char.**—Teeth of the *calyx* 5, acute, unequal, persistent. *Petals* obovate, emarginate, with an inflexed lobe, the exterior radiating, bifid. *Fruit* globose, 10-ribbed, scarcely separating. *Mericarps* [half-fruits] with five primary, depressed, wavy ridges, and four secondary ones [besides the marginals] more prominent and keeled. *Channels* evittate. *Commissure* bivittate. *Carpopodium* in the middle face, semi-bifid, adnate at the base and apex. *Seed* excavated in the front, covered with a loose membrane.—Smooth *herbs*. *Stem* round. *Leaves* (upper ones at least) many-cleft. *Umbels* with three to five rays. *Involucre* none. *Involucella* about 3-leaved, halved. *Flower-bud* sometimes roseate. *Flowers* white. *Stylopodium* conical (De Cand.)

Sp. Char.—The only species.

Root tapering. *Stem* erect, twelve to eighteen inches high. *Leaves* scarcely stalked, all bipinnate and cut; the *leaflets* of some of the lowermost wedge-shaped or fan-shaped; acute notched; of the rest, in fine, linear segments. *Flowers* white, often with a reddish tint.

Hab.—Grows wild about Ipswich and some parts of Essex, but is not really indigenous. Native of the south of Europe. Cultivated in Essex.

DESCRIPTION.—The fruit, commonly termed *coriander seeds* (*fructus seu semina coriandri*) is globular, about the size of white pepper, of a greyish-yellow colour, and is finely ribbed. It consists of two hemispherical mericarps, adherent by their concave surfaces. Each mericarp has five primary ridges, which are depressed and wavy; and four secondary ridges, more prominent and carinate. The channels are without vittæ, but the commissure has two. The odour of coriander is peculiar and aromatic.

COMPOSITION.—The odour, taste, and medicinal qualities of the fruit depend on volatile oil.

VOLATILE OIL OF CORIANDER (*Oleum Coriandri*).—Yellowish; smells strongly and pretty agreeably of the coriander. Sp. gr. is 0·871, boiling point 302: it consists of C 77·92, H11·69, O10·39, giving its formula $C_{10}H_9O=C_{10}H_8+HO$. Hence it appears to be a hydrate of an oil of the camphine group, having the same composition as oil of turpentine.[1]

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[1] *Exod.* xvi. 31.
[2] *Opera*, 359, 529, &c. ed. Fœs.
[3] Lib. iii. cap. 71.
[4] *Hist. Nat.* lib. xx. cap. 82, ed. Valp.

Physiological Effects. — Aromatic stimulant, like the other carminative umbelliferous fruits.

Uses.—Dr. Cullen considered coriander as more powerfully correcting the odour and taste of senna than any other aromatic; and hence it was formerly a constituent of the compound infusion of senna, though now ginger is substituted for it. It is only employed in medicine as an adjuvant or corrigent. It is used, however, by the confectioners and distillers. It is a constituent of the *Confectio sennæ.*—The dose of coriander is ʒss. to ʒj.

2. Umbelliferous Roots used in Medicine.

There are only two umbelliferous roots used in medicine and introduced into the Pharmacopœia. These are, *Angelica* and *Carrot.* Both contain a volatile oil.

250. ARCHANGELICA OFFICINALIS, *Hoffm.* and *Koch.*—GARDEN ANGELICA.

Angelica Archangelica, Linn. *E. D.*

Sex. Syst. Pentandria Digynia.

(Root, *E.*—Semina, *D.*)

History. — It is doubtful whether the ancient Greeks and Romans were acquainted with this plant, as no certain notice of it appears in their writings. C. Bauhin[2] calls it *Angelica sativa.*

Botany. **Gen. Char.**—Margin of the *calyx* with 5 short teeth. *Petals* elliptical, entire, acuminate, with the point curved inwards. *Fruit* somewhat compressed at the back, with a somewhat central raphé, 2-winged on each side. *Mericarps* [half-fruits] with thick, keeled ridges; the three dorsal ones elevated, the two lateral ones dilated into a twice as broad wing. *Seed* not adhering to the integument; the nucleus free, covered all over with numerous vittæ. *Carpophorus* 2-partite. — Perennial *herbs.* *Leaves* pinnatisect; segments broadly ovate, acute, coarsely dentate, terminal, lobed. *Petioles* large, sheathing, saccate. *Involucre* scarcely any; *partial one* halved, many-leaved. *Flowers* white, or greenish (De Cand.)

Sp. Char. — *Stem* smooth, terete, striated. *Leaves* bipinnatisect; segments subcordate, lobed, sharply serrated, the odd one 3-lobed; sheaths loose, saccate. Leaflets of the *partial involucre* equalling the partial umbel (De Cand.)

Root biennial, large, fleshy, branched, resinous, pungently aromatic. *Stem* four or five feet high, a little glaucous. *Foliage, stalks,* and even the *flowers,* bright green. It flowers from June to September.

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[1] A. Kawallier *Sitzungsber, der Kaiserl. Akad. der Wiss.,* vol. ix. p. 313: from *Pharm. Journ.* vol. xii. p. 396, 1853.

[2] *Pinax,* 155.

Hab.—Indigenous; northern parts of Europe. Cultivated in moist situations, and on the banks of ditches.

DESCRIPTION.—The dried angelica root (*radix angelicæ*) of the shops is imported from Hamburg in casks. In 1839 duty (4s. per cwt.) was paid on 386 cwts. Formerly *Spanish angelica* was alone employed for medicinal purposes. The dried root of the shops consists of a short cylindrical head, from which numerous branches arise. The size of these branches varies: the larger ones are as thick as the little finger, and six or eight inches long. Externally the root is corrugated, and greyish-brown. Internally it is dirty white, and presents, when cut transversely, numerous dark points, which are the cut extremities of vessels or intercellular spaces filled with a liquid, strongly odorous oil or oleo-resin. To the taste the root is at first sweet, then hot, aromatic, and bitter. The odour is peculiar, and not very disagreeable. The fruit, called *angelica seeds* (*fructus* seu *semina angelicæ*), have the odour and taste, but in a diminished degree, of the root.

COMPOSITION.—Angelica root has been analysed by John,[1] and by Bucholz and Brandes. The latter chemists obtained *volatile oil* about 0·70, *acrid soft resin* 6·02, *bitter extractive* 26·40, *gum* with some common salt 31·75, *starch* (not inulin) 5·40, *woody fibre* 8·60, *peculiar matter* (oxidised extractive?) 0·66, *albumen* 0·97, *water* 17·50, [loss 2·0]. The aromatic qualities of the root and seeds depend on the volatile oil and resin.

PHYSIOLOGICAL EFFECTS.—Both root and seeds are pungent aromatic stimulants and mild tonics.

USES.—Angelica (either root or seeds) is scarcely employed in modern practice, though it was formerly much esteemed. The tender stems, stalks, and midribs of the leaves are made, with sugar, into a sweetmeat or candy (*candied angelica; caules* seu *rami angelicæ conditi*), which, taken as a dessert, is a very agreeable stomachic. The *seeds* were formerly used in the preparation of the *Spiritus anisi compositus* of the Dublin Pharmacopœia. The principal consumption of angelica root and seeds is by rectifiers and compounders in the preparation of gin and the liqueur termed *bitters*.

251. DAUCUS CAROTA (var. SATIVA), *Linn.*—COMMON OR WILD CARROT.

Sex. Syst. Pentandria Digynia.

(Fructus; Radix recens, *L.*—Radix, *D.*)

D. Carota var. *sativa*, De Candolle, *E.* (Root).

D. Carota var. *sylvestris*, D. (Semina).

HISTORY.—According to Dr. Sibthorp,[2] this plant is the σταφυλῖνος of Dioscorides.[3] Hippocrates[4] employed it in medicine under the same name. The σταφυλῖνος ἄγριος of Dioscorides is, according to Dr. Sibthorp, the *Daucus guttatus*.

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[1] Gmelin, *Handb. d. Chem.*

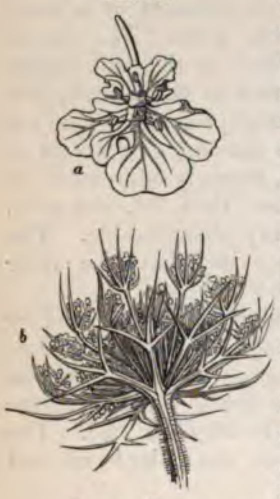
[2] *Prodr. Fl. Græc.* i. 183.

[3] Lib. iii. cap. 59.

[4] Page 686, ed Fœs.

BOTANY. **Gen. Char.**—Margin of the *calyx* 5-toothed. *Petals* obovate, emarginate, with an inflexed point; the outer generally radiating, and deeply bifid. *Fruit* somewhat compressed from the back, ovate or oblong. *Mericarps* [half-fruits] with the five primary ridges filiform and bristly; the three middle ones at the back; the two laterals on the plane of the commissure; the four secondary ridges equal, more prominent, winged, split into a simple row of spines. *Channels* beneath the secondary ridges 1-vittate. *Seed* anteriorly flattish.—Usually biennial *herbs*. *Leaves* bipinnatisect. *Involucre* of many, tri-, or pinnatifid leaflets; partial involucre of many, entire, or trifid leaflets. *Flowers* white or yellow; the central generally fleshy, blackish-purple, sterile (De Cand.)

FIG. 40.



Daucus Carota.
a, flower of the ray.
b, an umbel of fruit.

Sp. Char.—*Stem* hispid. *Leaves* 2- or 3-pinnatisect; the segments pinnatifid; the lobes lanceolate, cuspidate, almost equal to the umbel. *Prickles* equal to the diameter of the oblong-oval fruit (De Cand.)

Root slender, yellowish, aromatic, and sweetish. *Stem* two or three feet high, branched, erect, leafy, hairy or bristly. *Leaves* on broad, concave, ribbed footstalks, distinctly hairy. *Umbels* large, white, except the one central neutral *flower*, which is blood-red. *Fruit* small, protected by the incurvation of the flower-stalks, by which the umbels are rendered hollow, like a bird's nest (condensed from Smith).

Hab.—Indigenous; in pastures and the borders of fields, in a gravelly soil, common. Europe, Crimea, and the Caucasus; from thence, probably, carried to China, Cochin-China, and America.

Daucus Carota var. *sativa*, DC., E.; *Cultivated* or *Garden Carrot*.—This has a thick succulent root, whose colour varies. Loudon mentions ten garden varieties.

DESCRIPTION.—The officinal *root* is that of the cultivated plant (*radix dauci sativi*). It is tap-shaped, now and then branched, reddish, or pale straw-coloured, succulent, of a peculiar, not unpleasant odour, and a sweet, mucilaginous, agreeable taste. *Carrot juice* (*rob dauci*) is reddish, turbid, with the odour and taste of the root. By standing, a feculent matter (*amylum dauci*), which has been recently employed in medicine, is deposited.[1] It coagulates at a temperature under 212° F. The coagulum is yellow, and when dried amounts to 0·629 of the juice. The root of the wild, or uncultivated, carrot is small, woody, acrid, and bitter, with a strong aromatic odour.

The officinal *fruits*, usually called *carrot seeds* (*fructus* seu *semina dauci sylvestris*), are those of the wild carrot: they are brownish, from one to one and a half lines long, with a peculiar and aromatic odour, and a bitter and warm taste. Their other characters have been already described. The seeds of the cultivated carrot are much milder.

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[1] *Pharm. Central-Blatt für* 1841, p. 204.

COMPOSITION.—The *fruit* (commonly termed *seeds*) has not been analysed; the seeds owe their peculiar properties to volatile oil (*oleum seminum dauci sylvestris*). The *root* has been analysed by Vauquelin,[1] by Wackenroder,[2] and by C. Sprengel.[3] The constituents of the expressed juice, evaporated to dryness, are, according to Wackenroder, *fixed oil with some volatile oil* 1·0, *carotin* 0·34, *uncrystallisable sugar with some starch and malic acid* 93·71, *albumen* 4·35, *ashes* composed of alumina, lime, and iron 0·60.

1. VOLATILE OIL OF CARROT TREE.—Colourless, has a smell of carrots, a strong, permanent, unpleasant taste, and a sp. gr. of 0·8863 at 54° F. It is little soluble in water, but very soluble in alcohol and ether. From 34lbs. of the fresh root only half a drachm of oil was obtained. It is probable that the *volatile oil of carrot-fruits* possesses analogous properties.

2. CAROTIN.—A crystalline, ruby red, tasteless, odourless, neutral substance. It is fusible and combustible, but not volatile, soluble in the mixed and volatile oils, slightly so in alcohol, not in ether unless fat oil be present. Its solutions are decolorised by solar light.

3. PECTIC ACID.—By the action of alkalies on the ligneous tissue of carrots, Braconnot procured *pectic acid*. I have repeated his experiments, and can confirm his statements, but the quantity obtained is small. Pectic acid consists, according to Frémy, of $C^{32}H^{22}O^{30}$.

PHYSIOLOGICAL EFFECTS AND USES.—The fruit (*seed* of the shops) of the carrot is an aromatic stimulant and carminative, like the other aromatic umbelliferous fruits. Aretæus says it possesses diuretic properties, a statement confirmed by Eberle.[4] It has been employed in suppressions of urine and painful micturition, and also in dropsies. The *expressed juice* has been used as an anthelmintic.

The boiled *root* is a well-known article of food. Raw scraped carrot is sometimes applied to chapped nipples: it is a stimulant, and occasionally proves a painful application. Boiled carrots are only employed in the form of poultice[5] to ill-conditioned sloughing sores.[6]

3. UMBELLIFEROUS FŒTID GUM RESINS.

These are solid compounds, essentially composed of *resin*, *gum*, and *volatile oil*. The most important are *Assafœtida*, *Galbanum*, *Ammoniacum*, *Sagapenum*, and *Opoponax*.

They are obtained from the roots and stems of umbelliferous plants growing in eastern countries, Persia especially. By distillation with water they yield a *volatile oil*. This oil, at least in the case of assafœtida, is sulphuretted. It is remarkable that many of the strong smelling fœtid volatile oils (as garlic, mustard, &c.) also contain sulphur. The action of alcohol and water upon these gum resins may be thus generally stated:—

Alcohol dissolves the *oil* and the *resin*, and leaves the *gum*. Water subsequently added to the alcoholic liquid precipitates the resin.

Water dissolves the *gum*, and suspends the *oil* and *resin*, forming a milky mixture.

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[1] *Ann. de Chem. et Phys.* xli. 46.

[2] Gmelin, *Handb. d. Chem.* ii. 1277.

[3] *Pharm. Central-Blatt für* 1832, p. 443.

[4] *Mat. Med.* 2d edit. ii. 260.

[5] For further details respecting the medicinal uses of the carrot, see Bridault, *Traité sur la Carotte, et Recueil d'Observations sur l'Usage et les Effets salutaires de cette Plante dans les Maladies externes et internes*, 8vo. Rochelle, An. xl.

[6] *Med. Observ. and Inq.* vol. iv. pp. 184-191, and 458.

We are in want of good means of distinguishing the different gum resins chemically. Their *peculiar odours* at present enable us to distinguish them. In some cases these odours become particularly distinctive by heat, as in the case of *ammoniacum*. The gum resin of *assafœtida* is reddened by light.

252. NARTHEX (*Ferula*) ASSAFŒTIDA, (*Falconer*).—THE ASSAFŒTIDA FERULA.

Sex. Syst. Pentandria Digynia.

(Gummi-resina, *L. D.* — Gummi-resinous exudation, *E.*)

HISTORY.—It is uncertain at what period assafœtida was first known or described. The difficulty in determining its history arises from the confusion which has existed with respect to the *Succus Cyrenaicus* and assafœtida. By many writers the two substances were considered to be identical;[1] but this opinion seems now to have been satisfactorily disproved by the discovery of the plant, called by the Greeks σίλφιων, by the Romans *laserpitium* (*Thapsia Silphion*, Viviani), which yields the Cyrenaic juice, and which agrees tolerably well with the rude figures struck on the Cyrenean coins.[2] It would appear, however, that the Cyrenaic juice becoming scarce, the ancients employed some other substance of similar, though inferior, properties, as a substitute, and to both of these they applied the term *laser*. "For many years," says Pliny,[3] "this plant [laserpitium or silphion] has not been found in Cyrenaica, because the publicans [or farmers of the taxes] who rent the pastures, finding it more profitable, destroy it as food for cattle. One stalk only, found in our days, was sent to the Emperor Nero. We may know when cattle meet with young shoots of it, by the sleeping of the sheep when they have eaten it, and the sneezing of the goats. For a long time past the only *laser* brought to us is that which is produced abundantly in Persia, Media, and Armenia; but it is far inferior to the Cyrenaic." It is not at all improbable that the *laser of Persia* may have been our assafœtida. The word "assafœtida," says Murray,[4] "seems to have been introduced by the monks into the school of Salernum." But it appears to have been of oriental origin, and may be, as some have suspected, derived from the word *laser*. Nicolaus Myrepsus,[5] almost the last of the Greek physicians, and who lived, according to Sprengel,[6] about 1227 A. D., speaks of ασαφιτιδα, "There are two kinds of *Assa* [i. e. *laser*, Lat. trans.]," says Avicenna,[7] "one *fetid*, the other *odoriferous*."[8]

BOTANY. **Gen. Char.**—*Umbels* compound. *Involucres* 0. *Calyx* obsolete. *Fruit* thin, compressed at the back with a dilated border. *Ridges* 3 only, dorsal. *Vittæ* 1 to each dorsal furrow, and 2 to the laterals. *Albumen* thin, flat.

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[1] See Geoffroy, *Tract. de Mat. Med.* ii. 609.

[2] *Penny Cyclopædia*, vol. viii. p. 265; and Lindley, *Fl. Med.* ii. 52.

[3] *Hist. Nat.* lib. xix. cap. 15, ed. Valp.

[4] *App. Med.* i. 361.

[5] *Antidotarius*, cap. xxvii. p. 365, quoted by Alston, *Mat. Med.* ii. 438.

[6] *Hist. de Méd.* iv. 368.

[7] Lib. 2ndus, tr. 2ndus, cap. 53.

[8] The word *ferula* is derived from *ferire*, to strike. The stalks were used as rods for children, because they made more noise than did harm (Loudon). The term *ferula* is, in fact, an English word to indicate the instrument with which scholars are beaten on the hand (Walker). The instrument is a little wooden pallet or slice (Chambers). Hence Martial calls it the *sceptrum pædagogorum* or *schoolmaster's sceptre* (see Lemery).

Sp. Char.—Assafœtida (Falconer). Radical *leaves* 3-parted; segments bipinnatifid, with oblong-lanceolate, obtuse, decurrent lobes.

Hab.—Saristan, Affghanistan, the Punjaub.

Root perennial, tapering, ponderous, increasing to the size of a man's arm or leg, covered with a blackish-coloured bark, beset near the top with many strong, rigid fibres; its internal substance white, fleshy, abounding with a thick, milky juice, which has an excessively strong, fetid, alliaceous smell. *Stem* two or three yards high or more, six or seven inches in circumference at the base, smooth. Radical *leaves* nearly two feet long. Kæmpfer[1] compares their shape to the leaves of Pæonia officinalis; but in colour, and other respects, he says they resemble Ligusticum Levisticum, or Lovage. The *fruit* is flat, thin, reddish-brown, like that of parsnip, only rather larger and darker (Kæmpfer).

This is now considered to be the genuine assafœtida plant; but there is reason to believe that a gum-resin, like assafœtida, is obtained from other species of ferula.[5] *Ferula persico* has been described by Dr. Pope[3] as the true assafœtida plant; and the *Edinburgh College* has admitted it as being, probably, one source of assafœtida. Michaux sent its fruits from Persia as assafœtida.[4] That it does really yield assafœtida seems furthermore probable, from the strong smell of that drug which pervades the whole plant.[5] It is, I think, not unlikely that the tear and lump assafœtida of the shops are procured from different species. Dr. Royle[6] suggests that *Prangos pabularia* was one of the kinds of *Silphion* of the ancients, and may be an assafœtida plant.

EXTRACTION.—Assafœtida is obtained by making incisions into the upper part of the root; the footstalks of the leaves and the fibres at the top of the root being previously removed. Kæmpfer divides the business of collecting into four parts; the *first* begins about the middle of April, and consists in digging the earth about the root, removing the leaves and fibres, which are afterwards laid over the root to defend it from the sun. The *second* commences on the 25th of May. Each collector is provided with a sharp knife to cut the root, a broad iron spatula to scrape off the juice, a cup fixed to his thigh to receive it, and two baskets hung over his shoulders upon a pole. The top of the root is then cut off transversely, and, on the third day (*i. e.* the 27th of May), the juice is scraped off and put into the cups. A fresh incision is then made, and the juice removed the day but one following (*i. e.* the 29th of May), when they again cut the roots. The cups are from time to time emptied into large vessels. The juice is exposed to the sun to become harder, and is conveyed home in the baskets (see fig. 40, p. 176). The *third* and *fourth* acts are mere repetitions of the second. The third commences about the 10th of June, the fourth about the 3d of July.

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[1] *Amœn. exot.* 535.

[2] Lindley, *Fl. Med.* p. 45-46; and *Bot. Reg.* Aug. 1839.

[3] *Phil. Trans.* vol. lxxv.

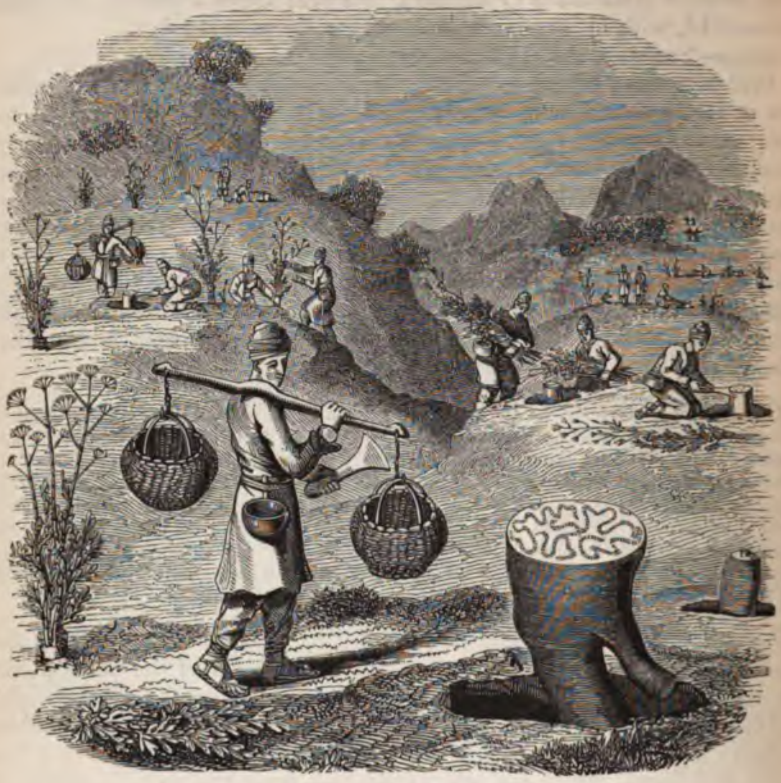
[4] Lindley, *Fl. Med.* 46.

[5] Stevenson and Churchill, *Med. Bot.* iv. 169; and Nees and Ebermaier, *Handb.* ii. 55.

[6] *Illustr.* 230.

Except after the last operation, the roots are carefully defended from the sun, after each incision, by covering them with leaves.[1]

FIG. 41.



Extraction of Assafœtida.

COMMERCE. — Assafœtida is exported from the Persian Gulf to Bombay, whence it is sent to Europe. [It comes over usually in chests or cases of from two to six hundredweight; the cases of fine quality averaging only from one to two hundredweight. The importation of assafœtida in the ten years from 1833 to 1844, amounted to 969 chests, or 97 chests per annum; while the consumption in those years was only 392 cwts., or 39 cwts. per annum.—ED.]

DESCRIPTION AND VARIETIES.—Assafœtida (*Assafœtida; Gummi Assafœtida*, offic.) occurs in irregular pieces of variable size. Externally they are yellowish- or pinkish-brown. The fracture is conchoidal, whitish, or milk-white, translucent, pearly, with a waxy lustre. By exposure to light and air the recently-fractured surface acquires, in a few hours, a violet-red or peach-blossom red colour, which after some days or weeks diminishes in intensity, and gradually passes into yellowish or pinkish-brown. Assafœtida is fusible and inflammable, burning in the air with a white flame and the evolution of much smoke. Its taste is acrid and bitter, and its odour strong, alliaceous, and peculiar; to most persons being remarkably disagreeable, whence the Germans have denominated assafœtida *Teufelsdreck* or *Stercus Diaboli;* in plain English, *Devil's Dung.* However, this dislike to the assafœtida is not universal; some of the Asiatics being exceedingly fond of it, taking it with their food as a condiment, or using it to flavour their sauces, or even eating it alone. Hence, among some of the older writers, we find it denominated *Cibus Deorum,—Food of the Gods.* Captain M. Kinnier[1] tells us, that in Persia the leaves of the plant are eaten like common greens, as is the root when roasted: and Lieut. Burnes,[2] speaking of assafœtida, says, "in the fresh state it has the same abominable smell; yet our fellow-travellers greedily devoured it." But the fondness for this substance is not confined to the Asiatics; for I am assured, by an experienced gastronome, that the finest relish which a beef-steak can possess, may be communicated by rubbing the gridiron, on which the steak is to be cooked, with assafœtida.

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[1] Kæmpfer, *op. cit.*

I am acquainted with three varieties only of assafœtida:—

α. **Assafœtida in the Tear** (*Assafœtida in granis* seu *lachrymis*). ? *Assafœtida of the Ferula persica.* — This kind, which is comparatively rare, occurs in distinct, roundish, flattened, or oval tears, and also in irregular pieces, varying from the size of a pea to that of a walnut, of a yellow or brownish-yellow colour externally, but white internally. I think it not at all improbable that this variety is obtained from a different plant to that which furnishes the lump variety; for its colour, externally, is more yellow, its odour is much feebler, and its fresh-fractured surface becomes more slowly and less intensely red by exposure to the air.[3] As it has considerable resemblance to *ammoniacum in the tear* (with which, indeed, except by its odour, it might be readily confounded), may it not be the substance which Olivier[4] calls ammoniacum, and which he says is produced by *Ferula persica?*

[Assuming that the assafœtida in the tear and in the lump are the products of different trees, as suggested by the author, it would appear that the trees must grow in the same locality, because it is a fact that tear assafœtida is seldom, if ever, seen alone in a package, but it is commonly mixed, in greater or less proportion, with that in masses, or lump assafœtida.—ED.]

β. **Lump Assafœtida** (*Assafœtida in massis*); *Assafœtida of the Ferula Assafœtida.* — This variety is the kind usually met with in the shops. It occurs in variable-sized masses, of irregular forms, and having a reddish or brownish-yellow colour. Frequently these masses are observed to be made up of tears, agglutinated by a reddish-brown substance: these form that kind of assafœtida sometimes denominated *amygdaloid* (*assafœtida amygdaloides*).

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[1] Ainslie, *Mat. Ind.* i. 21.

[2] *Travels*, ii. 243.

[3] [According to Guibourt, the reason why it does not become so red by exposure to air is owing to the fact that it contains less volatile oil.—ED.]

[4] Fée, *Hist. Nat. Pharm.* ii. 199.

γ. **Stony Assafœtida** (*Assafœtida petræa*).—I have never met with this kind in English commerce. My samples were received from Dr. Martiny. It occurs in irregular, more or less angular pieces, which have the odour of assafœtida, and a yellowish-brown colour, and present numerous small shining points or plates. It slightly effervesces in hydrochloric acid. By incineration it yields a white ash, which strongly effervesces on the addition of acids. Angelini found in stony assafœtida, 51·9 per cent. of gypsum. [We are indebted to Mr. Faber for a specimen of this variety, and we are informed by him that it is now frequently imported.—ED.]

COMPOSITION.—Assafœtida has been analysed by Pelletier,[1] Trommsdorff, Brandes, and Angelini:[2]—

Pelletier's Analysis.	
Resin	65·00
Gum	19·44
Bassorin	11·66
Volatile oil	3·60
Supermalate of lime, and loss	0·30
Assafœtida	100·00

Brandes's Analysis.	
Resin	48·85
Gum, with traces of saline matters	19·40
Bassorin	6·40
Volatile oil	4·60
Extractive, with saline matters	1·40
Sulphate and carbonate of lime	9·70
Oxide of iron and alumina	0·40
Sand and lignin	4·60
Water	6·00
Assafœtida	101·35

1. VOLATILE OIL OF ASSAFŒTIDA.—This is obtained by distilling assafœtida with either water or alcohol. It is on this principle that the odour of this gum-resin depends. It is lighter than water, and is at first colourless, but by exposure to the air acquires a yellow tinge. It dissolves in all proportions in alcohol and ether, but requires more than 2000 times its weight of water to dissolve it. Its taste is at first mild, then bitter and acrid: its odour is very strong. It evaporates very quickly, and soon fills a large room with its odour. Sulphur, and probably phosphorus, are among its elementary constituents. The presence of sulphur in assafœtida is shown in various ways: thus if chloride of barium be added to water distilled from assafœtida, and likewise a little chlorine, the sulphur becomes gradually acidified, and after some time a precipitate of sulphate of baryta is formed. If the oil be rubbed with mercury, it forms sulphate of mercury. Moreover, if pills made of assafœtida be rolled in silver leaf, the latter, after a few days, is blackened by the formation of a sulphuret of silver. According to Hlasiwetz the oil is composed of two sulphurets of the hydrocarbon, $C^{12}H^{11}$, and when fresh distilled, like the essential oil of black mustard and horseradish, it contains no oxygen. It becomes acid by exposure to air, and on boiling the oil hydrosulphuric acid is disengaged.

2. RESIN OF ASSAFŒTIDA.—The resinous matter of assafœtida is soluble in alcohol. When the alcoholic solution is mixed with water, a milky fluid is formed, owing to the deposition of the *hydrated resin*. Oil of turpentine and the oil of almonds also dissolve the resin, but less readily than alcohol. The resin obtained by evaporating the alcoholic solution consists, according to Johnston, of $C^{40}H^{26}O^{10}$. By exposure to the sun's rays it becomes violet red. Brandes has shown that the resin of assafœtida is of two kinds; one insoluble in ether, the other soluble. The proportion of the first to the second is as 1·6 to 47·25.

α. *Resin insoluble in ether.*—Is brownish-yellow, brittle, tasteless, has a slight alliaceous odour, is fusible, and soluble in warm caustic potash.

β. *Resin soluble in ether.*—Is greenish-brown, brittle, has an aromatic odour, and a faint but permanent, alliaceous bitter taste. Chloride decolorises it. Cold oil of vitriol renders it dark red: if heat be applied, sulphurous acid is evolved, and the mixture becomes black; if the liquid be diluted with water, and saturated with an alkali, the surface assumes a sky-blue colour. Nitric acid renders it first orange, then yellow, and makes it almost insoluble in ether. Hydrochloric acid dissolves it, and colours it pale-red. It dissolves in boiling concentrated acetic acid, but is deposited when the solution cools.

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[1] *Bull. de Pharm.* iii. 556.

[2] Gmelin, *Handb. d. Chem.* ii. 624.

CHARACTERISTICS.—Assafœtida possesses the usual characteristics of a gum-resin. From other gum-resins it is distinguished by its peculiar odour, which is especially obvious when a small portion of this substance is heated on the point of a knife, and by its fresh-fractured surface becoming red on exposure to air. Heated with sulphuric acid it is blackened, yields a dark, blood-red liquid, and developes sulphurous acid gas: if the liquid be diluted with water, and saturated with caustic potash, it becomes blue, especially on the surface, by reflected light, similar to that observed when disulphate of quina is dissolved in water (see *ante*).

PHYSIOLOGICAL EFFECTS.— Assafœtida is usually placed, by pharmacological writers, among those remedies denominated antispasmodics or stimulants. It is the most powerful of the fetid gum-resins. Its local effects are moderate: it is devoid of those acrid and irritating properties possessed by gamboge, euphorbium, scammony, and many other resinous and gummy-resinous substances. In the mouth, as already mentioned, it causes a sensation of heat, and the same effect, accompanied by eructations, is experienced in the stomach, when it is swallowed. In Professor Jörg[1] and his pupils (males and females), who endeavoured to elucidate the effects of this medicine by experiments made on themselves, doses of assafœtida, not exceeding a scruple, caused uneasiness and pain of the stomach, increased secretion of the gastro-intestinal membrane, and alvine evacuations. The pulse was increased in frequency, the animal heat augmented, the respiration quickened, and the secretions from the bronchial membrane and skin promoted. A very constant effect was headache and giddiness. The urino-genital apparatus appeared to be specifically affected, for in the males there was an increase of the venereal feelings, with irritation about the glans penis, while in the females the catamenial discharge appeared before its usual period, and uterine pain was experienced. These stimulant effects of assafœtida were observed in a greater or less degree in all the nine persons experimented on; and it should be borne in mind, that the dose did not, in any one case, exceed a scruple. Very opposite to these results, and to the observations of practitioners generally, is the statement of MM. Trousseau and Pidoux,[2] who tell us that they have taken half an ounce of good assafœtida at one dose, with no other effect than that of altering the odour of their secretions, by which they were kept for two days in an infected atmosphere, possessing a more horrible degree of fetidity than even assafœtida itself! These apparently contradictory results seem to prove that different individuals are most unequally susceptible of the influence of this remedy. The influence of assafœtida in convulsive and spasmodic diseases seem indisputable. As in these cases the functions of the excito-motory system are the functions principally or essentially involved, it is not assuming too much to suppose that the influence of assafœtida is principally directed to the excito-motory nerves. To paraphrase the words of Dr. M. Hall,[1] assafœtida acts through the *excitor* nerves; its effects are manifested through the *motor* nerves. The varying degrees of excitability or susceptibility (natural and morbid) of these nerves in different subjects, will, perhaps, in some measure account for the unequal effects produced by this agent on different healthy individuals, as well as for the therapeutical influence in certain subjects being disproportionate to the observed physiological effects.

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[1] Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. ii. 366.

[2] *Traité de Thérap.* p. 12-13.

Assafœtida, or its odorous principle, becomes absorbed by the veins, though slowly. Flandrin[2] gave half a pound of this gum-resin to a horse; the animal was fed as usual, and killed sixteen hours afterwards. The odour of assafœtida was distinguished in the veins of the stomach, of the small intestine, and the cæcum: it was not noticed in the arterial blood, nor in the lymph. Tiedemann and Gmelin[3] were not successful in their search for it; they gave two drachms of assafœtida to a dog, and at the end of three hours were unable to recognise the odour of it either in the chyle of the thoracic duct, or in the blood of the splenic and portal veins; but they detected it in the stomach and small intestines. In farther proof of the opinion that assafœtida becomes absorbed, may be mentioned the detection of the odour of this substance in the secretions. The experience of MM. Trousseau and Pidoux, already related, may be adduced as corroborative of this statement. We are told that the transpiration of Asiatics who use assafœtida daily, is extremely fetid; a circumstance to which Aristophanes[4] alludes. Vogt[5] says, that the secretions from carious ulcers sometimes smell of assafœtida, when this substance has been taken for some time.

The stimulant influence of assafœtida over the organs of circulation and of secretion (as the bronchial membrane and skin), depends apparently on the topical action of the oily and resinous particles on the vessels in their passage through the latter.

USES.—From the foregoing remarks it will be readily gathered, that assafœtida is contra-indicated in febrile and inflammatory diseases, on account of its stimulant properties; as also in vascular irritation, or inflammation of the stomach, on account of its topical influence on this viscus. On the other hand, it is found highly useful in spasmodic or convulsive diseases not dependent on disease of the nervous centres, but of the kind called by Dr. Hall eccentric.

1. *In spasmodic and convulsive diseases.*—Few remedies have acquired such celebrity in *hysteria*, as assafœtida. Dr. Cullen[6] speaks in the highest terms of it, and I believe the experience of most practitioners corroborates his opinion of its virtues. "I have found it," says he, "to be the most powerful in all hysteric cases; and when the presence of an hysteric paroxysm prevented medicines being taken by the mouth, I have found it given in clyster to be very effectual." When the circula-

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[1] *Lectures* in the *Lancet*, April 14, 1838.
[2] Magendie, *Physiol.* by Milligen, 288, 1823.
[3] *Versuch*, S. 9.
[4] *Equites*, Act ii. Scen. 4.
[5] *Pharmakodyn.* ii. 126. 2te Aufl.
[6] *Mat. Med.* ii. 367.

tion is very languid, ammonia may with advantage be conjoined. Schönheyder[1] recommends assafœtida with opium in the form of clyster. In *infantine convulsions,* clysters of assafœtida are often used with good effect. Even in the *epilepsy* of adults they are not always without value. In purely *spasmodic asthma,* I have never seen relief from the use of assafœtida. This observation, which accords with Dr. Cullen's experience, does not agree with the statements of others. Trousseau and Pidoux[2] declare they have seen it produce good and undoubted effects. But in old chronic catarrhs, with occasional spasmodic difficulty of breathing and spasmodic cough, I have procured the most marked relief by the combined use of assafœtida and ammonia. I have no experience of the use of this gum-resin in the disease called *laryngismus stridulus,* in which Millar,[3] and others, have found it beneficial. In *hooping cough,* both Millar and Kopp[4] have found it beneficial. It promotes expectoration, and diminishes both the violence and frequency of the attacks. The repugnance which children manifest to its use is, however, a great drawback to its employment. In *flatulent colic* of hysterical and dyspeptic individuals, or of infants, few remedies are more efficacious, when the disease is unaccompanied by any marks of inflammatory action, and is attended with constipation. Of its efficacy in the flatulent colic of infants, I can speak from repeated observation; it is given with great benefit in the form of clyster. In most cases, its laxative operation is an advantage; but should this be an objection, it may be counteracted by the addition of laudanum.

2. *As a stimulating expectorant and antispasmodic in chronic catarrh,* it is often of considerable use. It is adapted for old persons, and where the disease is of long standing. I have found it most beneficial in those cases where the cough and difficulty of breathing assume at intervals a spasmodic form, and where the wheezing is considerable. In such I have found full doses of assafœtida with ammonia give great relief. In delicate females, subject to repeated attacks of catarrh, attended with wasting, sweating, and other constitutional symptoms of phthisis, I have found assafœtida of frequent benefit. In these cases it does not act merely by its expectorant effects, for oftentimes one good consequence of its use is diminution of excessive bronchial secretion.

3. *In affections of the alimentary canal.*—The use of assafœtida *in flatulent colic* has been above noticed. It is often of considerable value in relieving flatulence in old persons, especially in hypochondriacal and hysterical subjects, and when accompanied with constipation, as it has a laxative effect. It provokes the expulsion of the gaseous matter, and appears to aid in preventing its reproduction. It is beneficially used in the form of clyster, to relieve a tympanitic condition of the abdomen and flatulent distention of the bowels in low fevers. In *constipation with flatulence,* it is a useful addition to purgative mixtures or enemata. It has often been used as an *anthelmintic,* but is of less frequent efficacy.

4. *As an emmenagogue in uterine obstructions* (amenorrhœa and chlorosis)

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[1] *Acta Reg. Soc. Hafn.* i. 168.

[2] *Op. cit.* p. 15.

[3] *Observations on the Asthma and Hooping Cough,* 1769.

[4] *Lond. Med. Gaz.* i. 581.

assafœtida has been employed from a notion that it specifically affected the womb,—an opinion which is supported by the reports of Jörg's female pupils, that it brought on the catamenial discharge earlier than usual. Experience, however, has not been much in favour of the emmenagogue operation of assafœtida when this remedy has been employed in uterine diseases. "Whether it be owing," says Dr. Cullen, "to the imperfect state, in which we too frequently have this medicine, or to somewhat in the nature of the amenorrhœa, I would not positively determine; but this is certain, that I have very seldom succeeded in employing the assafœtida as an emmenagogue."

5. *As a condiment.*—I have already referred to the condimentary uses made of assafœtida, especially by oriental nations. At the Pass of "Dundan Shikun," says Lieutenant Burnes,[1] "we found the assafœtida plant in exuberance, and which our fellow-travellers ate with great relish." It is much used by the Brahmins against flatulence, and to correct their cold vegetable food.[2]

ADMINISTRATION.—The dose of assafœtida is from grs. v. to ℈j. or ʒss. It may be given in substance, in the form of *pill*, or made into an *emulsion*. In hysteria and flatulent colic, where we want an immediate effect, it is best administered in a liquid form. Used as an *enema*, it may be administered to the extent of two drachms, rubbed up with warm water. The following are the officinal preparations of assafœtida:—

1. ENEMA ASSAFŒTIDÆ, L. [*Enema Fœtidum*, D. E.]; *Assafœtida* or *Fetid Clyster*. (Assafœtida, prepared, ʒj.; decoction of Barley, Oss. Beat up the assafœtida with the decoction gradually added until they are perfectly mixed. According to the Dublin Pharmacopœia, two drachms of the tincture are to be added to twelve ounces of water.)—The fetid clyster is a valuable stimulant, antispasmodic, and carminative purgative, which may be used with most beneficial results in hysteria, flatulent colic, infantile convulsions, and worms in the rectum.

2. TINCTURA ASSAFŒTIDÆ, L. E. D.; *Tincture of Assafœtida*. (Assafœtida, in small fragments, ℥v.; Rectified Spirit, Oij. Macerate for fourteen [seven, *L. E.*] days, and strain. "This tincture cannot be made by percolation, without much delay," *E.*)—Stimulant and antispasmodic. Used in hysteria and flatulent colic. Dose, ʒss. to fʒij. Pennyroyal is a good vehicle for it. When mixed with aqueous liquids, it becomes milky, owing to the deposition of the hydrated resin.

3. PILULA ASSAFŒTIDÆ, D. E.; *Assafœtida Pills*. (Assafœtida, Galbanum, and Myrrh, *three parts* of each; Conserve of Red Roses, *four parts*, or a sufficiency; mix them, and beat them into a proper pill mass, *E.*—Galbanum, ℥j.; Myrrh and Treacle, of each ℥j.; Assafœtida, ʒij. Heat all the ingredients in a capsule, by means of a steam or water bath, and stir the mass until it assumes a uniform consistence, D.)—As the most powerful ingredient of this combination is assafœtida, the more appropriate name for the pills would be *pilulæ assafœtidæ compositæ*. This compound is stimulant and antispasmodic. It is used in hysteria, chlorosis, &c. Dose, grs. x. to ℈j.

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[1] *Travels*, i. 143.

[2] Ainslie, *Materia Indica*, vol. i. 21.

4. PILULA ALOES ET ASSAFŒTIDÆ, E. (Socotrine Aloes, Confection of Roses, Assafœtida, Soap, of each equal parts. Mix.)—An antispasmodic and purgative, allied to the Pilula Sagapeni Composita of the former London Pharmacopœias.

5. SPIRITUS AMMONIÆ FŒTIDUS, L. E. D. (See *ante.*)

6. EMPLASTRUM ASSAFŒTIDÆ, E.; *Plaster of Assafœtida.* (Litharge Plaster, Assafœtida, of each ℥ij.; Galbanum, Bees'-wax, of each ℥j. Liquefy the gum-resins together, and strain them; then add the plaster and wax, also in the fluid state, and mix them all thoroughly.)—It is applied as an antispasmodic, over the stomach or abdomen in hysteria with flatulence, to the chest or between the shoulders in hooping cough.

253. FERULA? AN UNCERTAIN SPECIES YIELDING SAGAPENUM, *L.*

Sex. Syst. Pentandria Digynia.

(Gummi-resina, *L.*)

HISTORY.—Sagapenum (σαγάπηνον) is mentioned both by Hippocrates[1] and Dioscorides.[2] Pliny[3] calls it *Sacopenium.* Dioscorides says it is a liquor obtained from a ferulaceous plant growing in Media.

BOTANY.—Nothing is known with respect to the plant yielding sagapenum. Willdenow considered it to be *Ferula persica,* and he has been followed by Sprengel and Fée. But his opinion was not supported by any well-ascertained fact; on the contrary, several circumstances already mentioned seem to show that this plant produces a kind of assafœtida. There is, indeed, no evidence to prove that sagapenum is got from a *Ferula,* for the statement of Dioscorides cannot be admitted as having much weight.

DESCRIPTION.—Two kinds of sagapenum (*sagapenum; gummi sagapenum*) are occasionally met with. The finest (*sagapenum in the tear*) consists of masses made up of agglutinated, brownish-yellow, semi-transparent tears, and resembling galbanum, but having a darker colour and a more alliaceous odour. A commoner kind (*soft sagapenum*) occurs in soft, tough masses, in which no distinct tears are distinguishable. When heated on the point of a knife in the candle, sagapenum gives out a much more aromatic and agreeable odour than galbanum. It has a hot and acrid taste. It is imported from the Levant.

COMPOSITION.—Sagapenum has been analysed by Pelletier,[4] and by Brandes.[5]

Pelletier's Analysis.

Resin	54·26
Gum	31·94
Volatile oil and loss	11·80
Bassorin	1·00
Malate of lime	0·40
Peculiar matter	0·60
Sagapenum	100·00

Brandes's Analysis.

Resins	50·29
Gum, with calcareous salts	32·72
Volatile oil	3·73
Bassorin	4·48
Malate and phosphate of lime	1·12
Impurities	4·30
Water	4·60
Sagapenum	101·24

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[1] Page 626, ed. Fœs.

[2] Lib. iii. cap 95.

[3] *Hist. Nat.* lib. xx. cap. 75, ed. Valp.

[4] *Bull. de Pharm.* iii. 481.

[5] Gmelin, *Handb. d. Chem.* ii. 625.

1. **OIL OF SAGAPENUM.**—Pale yellow, lighter than water, soluble in alcohol and ether. Has a strong alliaceous odour, and a mild (afterwards hot) bitter, alliaceous taste. Sulphuric acid renders it dark red.

2. **RESIN OF SAGAPENUM.**—Obtained by evaporating an alcoholic solution, it is pale yellow, having a strong garlic odour, and becoming fluid at 212° F. Its composition, according to Johnston, is $C^{40}H^{29}O^{9}$. By the action of ether it is resolved into two resins.

α. *Resin insoluble in ether.*—Brownish-yellow, tasteless, odourless, fusible, soluble in warm liquor potassæ and in spirit, but insoluble in the oils of turpentine and almonds.

β. *Resin soluble in ether.*—Reddish-yellow, with a feeble odour of sagapenum, and a mild (afterwards bitter) taste. It is soluble in spirit, and slightly so in the oils of turpentine and almonds. It dissolves in sulphuric acid, forming a blood-red solution, from which water separates a violet substance.

PHYSIOLOGICAL EFFECTS AND USES.—Its effects and uses are the same as those of assafœtida. It is usually considered to hold an intermediate rank between assafœtida and galbanum; but it is rarely employed.

ADMINISTRATION.—It is given in substance, in the form of pill, in doses of from grs. v. to ℈j. or ʒss.

1. SAGAPENUM PRÆPARATUM. (Prepared in the same manner as directed for Ammoniacum: vide *Ammoniacum præparatum.*)—It enters into the composition of the *Pilula Galbani Composita* of the London Pharmacopœia (see *post*). Sagapenum is used as a warm stimulating purgative in dyspepsia, with flatulence and costiveness. Dose grs. v. to ℈j.

254. DOREMA AMMONIACUM, *Don.*—THE AMMONIACUM DOREMA.

Sex. Syst. Pentandria Digynia.

(Gummi-resina, *L.*—Gummi-resinous exudation, *E.*)

HISTORY.—The term *ammoniacum* has been applied to two different gum-resins; one, the produce of *Ferula tingitana;* the other, of *Dorema Ammoniacum*. The first is the ammoniacum of Hippocrates,[1] Dioscorides,[2] and Pliny;[3] the latter is the commercial ammoniacum of the present day.

Dioscorides says ἀμμωνιακόν is obtained from a species of *Ferula*, which he calls ἀγασολλῖς, growing near Cyrene, in Africa. Pliny terms the plant *Metopion*, and says it grows in that part of Africa which is subject to Æthiopia, near the temple of Jupiter Ammon, which, as well as the gum-resin, received its name from ἄμμος, *sand*, on account of the sandy soil of the country. Both Dioscorides and Pliny mention two kinds of ammoniacum: the best, called *Thrauston* (ϑραῦσμα) resembled olibanum, and had an odour like castoreum, and a bitter taste; and the commonest, termed *Phyrama* (φύραμα) had a resinous appearance, and was adulterated with earth and stones. *African ammoniacum* (in Arabic, *Fasògh* or *Feshook*) is, Dr. Lindley informs me, "certainly the produce of Ferula tingitana."

I have not been able to ascertain when *Persian ammoniacum* (the produce of *Dorema Ammoniacum*) first came into use. As the Greeks and Romans make no mention of it, they were, probably, unacquainted with it. Avicenna[1] does not mention the origin of his ammoniacum (*assach*, Arab.) The ammoniac (*eschak*, Arab.) of Abu Mansur Mowafik,[2] an ancient Persian physician, who wrote about 1055 A.D., was doubtless of the Persian kind; as was also the ammoniac (*derukht ushak*) of Beva Ben Khuas Khan, A.D. 1512.[3] The Arabic terms (*assach*, *ushak*, and *oshac*,) by which the three last-named authors designate ammoniac, resemble the name (*oshac*) by which the ammoniacum plant is now known in Persia;[4] hence we infer they all referred to the same object.

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[1] Page 670, ed. Foes.

[2] Lib. iii. cap. 98.

[3] *Hist. Nat.* lib. xii. cap. 49, ed. Valp.

BOTANY. **Gen. Char.**—Epigynous *disk* cup-shaped. *Fruit* slightly compressed from the back, edged; with three distinct, filiform, primary ridges near the middle, and, alternating with them, four obtuse secondary ridges; the whole enveloped in wool. *Vittæ*, 1 to each secondary ridge, 1 to each primary marginal ridge, and 4 to the commissure, of which two are very small (Lindley).

Sp. Char.—The only species.

A glaucous green plant, about 7 feet high, looking like the Opoponax. *Root* perennial. *Stem* about 4 inches in circumferences at the base. *Leaves* large, petiolate, somewhat bipinnate, 2 feet long; pinnæ in three pairs; petioles downy, sheathing at the base. *Umbels* proliferous, racemose; partial ones globose, on short stalks, often arranged in a spiked manner. *Involucre*, general or partial, none. *Petals* white. *Stamens* and *styles* white. *Ovaries* buried in wool. *Fruit* naked. (Condensed from Don.)

Hab.—Persia, in the province of Irak, near Jezud Khast, and on the plains between Yerdekaust and Kumisha.

[Buhse found the plant which yields the gum ammoniacum[5] at the foot of the mountains of Kuni Nirehm. He considers that it is not the Dorema Ammoniacum, but the Dorema which grows on sandy and rocky elevations from 3000 to 3500 feet above the level of the sea.—ED.]

EXTRACTION.—The whole plant is abundantly pervaded with a milky juice, which oozes forth upon the slightest puncture being made, even at the end of the leaves. This juice, when hardened, constitutes ammoniacum. Through the kindness of my friend Dr. Lindley, there is in my museum the upper part of the (apparently flowering) stem, about ten inches long, with lumps of ammoniacum sticking to it at the origin of every branch. It was gathered by Sir J. M'Niell, in Persia (I believe between Ghorian and Khaff). It does not appear that artificial incisions are ever made in the stem. Lieut.-Col. Kennet[6] says, "When the plant has attained perfection, innumerable beetles, armed with an anterior and posterior probe of half an inch in length, pierce it in all directions; it [ammoniacum] soon becomes dry, and is then picked off, and sent *viâ* Bushire to India and various parts of the world."

COMMERCE.—Ammoniac is usually imported from Bombay, but occasionally it comes from the Levant. It is brought over in chests, cases, and boxes. The quantity imported is but small. [It is imported in cases of about two hundredweight each. In the years 1833-44, the importation amounted on an annual average to 63 chests, and the average annual consumption in this country amounted to about 22 chests.—ED.]

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[1] Lib. ii. cap. 8.
[2] *Lib. Fund. Pharm.* i. 35, ined. R. Seligmann, 1830.
[3] Ainslie, *Mat. Ind.* i. 160.
[4] *Linn. Trans.* xvi. 605.
[5] *Pharm. Journal*, xi. p. 526.
[6] *Linn. Trans.* xvi. 605.

DESCRIPTION.—Common or Persian ammoniacum, usually termed *gum ammoniacum* or *ammoniac* (*gummi ammoniacum*), occurs in two forms; *in the tear* and *in the lump*.

α. **Ammoniacum in the Tear** (*Ammoniacum in lachrymis* seu *granis*) occurs in distinct dry tears, usually more or less spheroidal, though frequently of irregular forms, varying in size from that of the fruit of coriander (or even smaller) to that of a walnut. Externally they are of a yellow (pale reddish or brownish) colour, with a waxy lustre; internally they are white or opalescent, opaque, or only feebly translucent at the edge of thin films. At ordinary temperatures it is moderately hard and brittle, but softens like wax in the hand.

β. **Lump Ammoniacum** (*Ammoniacum in placentis* seu *massis*).—This occurs in masses usually composed of agglutinated tears, whose properties it possesses. It is sometimes met with in soft plastic masses of a darker colour, and mixed with various impurities. To separate these, it is melted and strained (*Strained ammoniacum; Ammoniacum colatum*).

Both kinds have a faint, unpleasant, peculiar odour, by which this gum-resin may be readily distinguished from all others. This odour is best detected by heating the ammoniacum on the point of a pen-knife. The taste is bitter, nauseous, and acrid. Umbelliferous fruits are not unfrequently found intermixed with both sorts. In most of its other properties ammoniacum agrees with other gum-resins.

I am indebted to Dr. Lindley for a fine sample of *African Ammoniacum* (ἀμμωνιακόν, Diosc.) It was sent by W. D. Hays, Esq., the British Consul at Tangier, to the Hon. W. T. Fox Strangways, and is marked, "*Gum Ammoniac* or *Fusògh*, Tangier, 17 June, 1839, J. W. D. H." It is an oblong piece, about three inches long, and one and a half inches thick, and broad. Its weight is about 830 grains. Externally it is irregular and uneven, and has a dirty appearance, similar to what ammoniacum would acquire from repeated handling and long exposure to the air in a dusty situation. It is partially covered with paper. A few pieces of reddish chalky earth (which effervesces with acids) are found sticking to it, thus confirming the account given of it by Jackson,[1] though the quantity of this on my specimen is not sufficient to affect in any way the saleability of it. It appears to be made up of agglutinated tears, like the lump Persian ammoniacum. Internally it has very much the appearance of lump ammoniacum, but is not so white, but has a brownish, reddish, and in some places a faint bluish tint. Its odour is very faint, and not at all like Persian ammoniacum. Heated on the point of a knife, its distinction from Persian ammoniacum is very obvious. Its taste is also much slighter than that of the commercial ammoniacum. Rubbed with water, it forms an emulsion like the latter. It is the produce of *Ferula tingitana* (Lindley).

COMPOSITION.—Ammoniacum has been analysed by Calmeyer, Bucholz,[2] Braconnot,[3] and by Hagen.[4]

Braconnot's Analysis.		*Hagen's Analysis.*	
Resin	70·0	Resin	68·6
Gum	18·4	Gum	19·3
Gluteniform matter, insoluble in water and alcohol	4·4	Gluten (colla)	5·4
Water	6·0	Extractive	1·6
Loss	1·2	Sand	2·3
		[Volatile oil and water	2·8]
Ammoniacum	100·0	Ammoniacum	100·0

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[1] *Account of the Empire of Morocco*, 3d edit. p. 156.
[2] Gmelin, *Handb. d. Chem.* ii. 624.
[3] *Ann. de Chimie*, lxviii. 69.
[4] Schwartze, *Pharm. Tabel.* 280, 2te Ausg.

1. VOLATILE OIL OF AMMONIACUM.—Transparent, lighter than water.

2. RESIN OF AMMONIACUM.—Reddish-yellow, tasteless, has the odour of the gum-resin. Soluble in alkalies and alcohol; partially soluble in ether and the oils (fixed and volatile). Its constitution, according to Johnston, is $C^{40}H^{25}O^{9}$.

PHYSIOLOGICAL EFFECTS.—The effects of ammoniacum are similar to, though less powerful than, those of assafœtida and of the other fetid gum-resins already mentioned. MM. Trousseau and Pidoux[1] assert that in all the cases in which they have employed it, it had no stimulant effect either local or general. "We have taken," say these authors, "two drachms of this substance at once, without experiencing any of those accidents complaisantly indicated by authors." I would remark, however, that the local irritation produced by the plaster of ammoniacum is known to most practitioners,—a papular eruption being a frequent result of the application of this agent. Ammoniacum contains much less volatile oil than either assafœtida or galbanum; its stimulant influence is less than either of these. Full doses of it readily disturb the stomach.

USES.—Though applicable to all the same cases as assafœtida and the other fetid gum-resins, its internal use is principally or almost solely confined to chronic pulmonary affections. It is not fittted for irritation or inflammation of the bronchial membrane. But in chronic coughs, with deficient expectoration, or in chronic catarrhs and asthmatic cases of old persons with profuse secretion, it sometimes gives slight relief. Though I have seen it extensively employed, in a few cases only have I observed it beneficial. [M. Delioux[2] considers that ammoniacum has scarcely any appreciable physiological action in a state of health, but that it diminishes excessive secretion from the bronchial mucous membrane, and acts also slightly as an antispasmodic.—ED.] As a topical, discutient, or resolvent application, in the form of plaster, to glandular enlargements and indolent affections of the joints, it occasionally proves useful.

ADMINISTRATION.—The dose of ammoniacum is from grs. x. to ʒss. It may be given in the form of pill or emulsion. It is a constituent of the *Compound pills of squills*, a very useful expectorant in old catarrhs.

1. **MISTURA AMMONIACI**, L. D.; *Lac Ammoniaci; Ammoniacum Mixture.* (Ammoniacum, ʒv. [ʒij. *D.*]; Water, Oj. [Water, f℥viij. *D.*] Rub the ammoniacum with the water gradually poured on, until they are perfectly mixed. [It should be strained through muslin, *D.*]).—The resinous constituent of ammoniacum is more effectually suspended in water by the aid of the yolk of an egg. This mixture operates as a stimulant to the bronchial membrane, and is used as an expectorant in chronic coughs, humoral asthma, &c. It is a convenient and useful vehicle for squills or ipecacuanha. Dose, f℥ss. to f℥j.

2. **EMPLASTRUM AMMONIACI**, L. E. D.; *Plaster of Ammoniacum.* (Ammoniacum, ℥v.; Diluted Acetic Acid, f℥viij.; [Distilled Vinegar, f℥ix. *E.*; Gum Ammoniac in coarse powder, ℥iv.; Proof Spirit, f℥iv.

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[1] *Traité de Thér.* p. 19.

[2] *Annuaire de Thérap.* 1856, p. 74.

D.] Dissolve the ammoniacum in the acid, vinegar, or spirit, then evaporate the liquor with a slow fire, *L.* [over the vapour-bath, *E.*; or water-bath, *D.*], constantly stirring, to a proper consistence. The best solvent is undoubtedly Proof Spirit, as recommended in the Dublin Pharmacopœia.)—A very adhesive, stimulant, and discutient or resolvent plaster. It sometimes causes an eruption. It is applied to indolent swellings, as of the glands and joints. A very useful application to the housemaid's swollen knee.

3. **EMPLASTRUM AMMONIACI CUM HYDRARGYRO**, L. E. D. (See *ante.*) [The appearance of a new edition of the Dublin Pharmacopœia since the first volume of this work was printed, renders it necessary to state here that the Emplastrum Ammoniaci cum Hydrargyro is no longer made as formerly directed. The present formula is Ammoniac Plaster, ℥iv.; and Mercurial Plaster, ℥viij. These plasters are melted together by means of a steam- or water-bath, and constantly stirred until the mixture stiffens on cooling.—ED.]

4. **AMMONIACUM PREPARATUM**, L.; *Prepared Ammoniacum.* (Ammoniacum in the mass, lb. j.; Water, as much as may be necessary to cover the ammoniacum. Boil until mixed; strain the mixture through a hair sieve, and evaporate by water-bath, carefully stirring, so that it hardens on cooling.)—This cleansing is only necessary for the ammoniacum as obtained in the mass (*lump ammoniacum*), but is not required for the *tear ammoniacum.*

255. GALBANUM OFFICINALE, *Don.*—OFFICINAL GALBANUM.

Sex. Syst. Pentandria Digynia.

(Gummi-resina, *L. D.*—Concrete gummy-resinous exudation of an imperfectly ascertained umbelliferous plant, probably a species of Opoidia, *E.*)

HISTORY.—Galbanum is mentioned by Moses,[1] who ranks it among the sweet spices. It was used in medicine by Hippocrates:[2] Dioscorides[3] says it (χαλβανη) is the μετώπιον, growing in Syria.

BOTANY.—Much uncertainty still exists respecting the plant which yields galbanum. "The *Bubon Galbanum* of Linnæus possesses neither the smell nor the taste of Galbanum, but in these particulars agrees better with Fennel, and the fruit has no resemblance whatever to that found in the gum."[4] The *Dublin College* in its new Pharmacopœia describes galbanum as the gum-resinous exudation of the *Opöidia galbanifera.* This is assigned on the authority of Lindley. Mr. Don found an umbelliferous fruit in the galbanum of commerce, which he believes to be that of the plant yielding this gum-resin; and, as it constitutes a new genus, he has called it *Galbanum officinale.* The following are the characters of the fruit:—

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[1] *Exodus*, xxx. 34.

[2] Page 401, &c. ed. Fœs.

[3] *Ibid.* iii. 97.

[4] Don, *Linn. Trans* xvi. 603.

Fruit compressed at the back, elliptical; *ridges* seven, elevated, compressed, bluntly keeled, not winged; the lateral distinct, marginal. *Channels* broadish, concave, without vittæ. *Commissure* flat, dilated, bivittate: *vittæ* broad, somewhat curved. (Don.)

But though it is not at all improbable that these fruits are the produce of the galbanum plant, yet no proof of this has been hitherto adduced, and Dr. Lindley, therefore, very properly asks, " Did the fruit found by Mr. Don upon the gum really belong to it ?"[1]

More recently Sir John M'Niell sent home specimens of a plant called *a second sort of ammoniacum*, gathered near Durrood, July 27, 1838, to the branches of which are sticking lumps of a pale yellow waxy gum-resin, which Dr. Lindley took for galbanum; and the plant which yields it being essentially different from all others, has been named by him *Opöidia galbanifera*,[2] the name now selected by the Dublin College. Dr. Lindley was kind enough to send me a small fragment of this gum-resin for examination, but I was unable to identify it with any other known product of the order Umbelliferæ. It certainly was neither assafœtida nor ammoniacum; nor did it appear to me to be either sagapenum or galbanum. The precise country where galbanum is produced has not been hitherto ascertained. Dioscorides says it is obtained in Syria; a statement which is perhaps correct, though hitherto no evidence of this has been obtained. It is not improbable that it is also procured in Persia, or even in Arabia, as suggested by Dr. Royle. Opöidia galbanifera grows in the province of Khorasan, near Durrood. The German pharmacologists distinguish two varieties—*Galbanum Levanticum* and *Galbanum Persicum*. The names indicate the localities whence they are supposed to be derived.

EXTRACTION.—Geoffroy[3] says, though I know not on whose authority, that galbanum is generally obtained by making an incision into the stalks about three fingers' breadth above the root, from which it issues in drops, and in a few hours becomes dry, and hard enough to gather.

DESCRIPTION.—The gum-resin galbanum (*galbanum* seu *gummi-resina galbanum*) occurs in the two forms of tears and lump.

α. **Galbanum in the Tear** (*galbanum in lachrymis* seu *granis*) is rare: it occurs in distinct, round, yellow or brownish-yellow, translucent tears; none of which, in my collection, exceed the size of a pea. Their fracture is feebly resinous and yellow.

β. **Lump Galbanum** (*galbanum in massis*) is the ordinary galbanum of commerce. It consists of large irregular masses of a brownish or dark brownish-yellow colour, and composed of agglutinated tears, some few of which, when broken, are observed to be translucent and bluish, or pearl-white. The mericarp, pieces of the stem, &c. are found intermixed with the tears. To separate these, galbanum is melted and strained (*strained galbanum*; *galbanum colatum*). The odour of both kinds is the same; viz. balsamic, and peculiar. The taste is hot, acrid, and bitter. When exposed to cold, galbanum becomes brittle, and may be reduced to powder. In many of its other properties it agrees with the other gum-resins. It is imported from the Levant and from India in cases and chests.

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[1] *Fl. Med.* 51.

[2] *Botanical Register* for August 1, 1839, p. 65-6.

[3] *Trait. de Mat. Méd.* ii. 623.

Recently another gum-resin from India has been introduced as galbanum; but it is said to resemble the latter in colour only, and to be unsaleable.[1]

COMPOSITION. — Galbanum has been analysed by Neumann,[2] Pelletier,[3] Fiddechow, and Meissner.[4]

Pelletier's Analysis.	
Resin	66·86
Gum	19·28
Volatile oil and loss	6·34
Wood and impurities	7·52
Supermalate of lime	traces
Galbanum	100·00

Meissner's Analysis.	
Resin	65·8
Gum	22·6
Bassorin	1·8
Volatile oil	3·4
Bitter matter with malic acid	0·2
Vegetable remains	2·8
Water	2·0
Loss	1·4
Galbanum	100·0

1. VOLATILE OIL OF GALBANUM.—Obtained by submitting the gum-resin, with water, to distillation. It is colourless and limpid. Its sp. gr. is 0·912; its odour is like that of galbanum and camphor; its taste is hot, afterwards cooling and bitterish. It is soluble in spirit, ether, and the fixed oils.

2. RESIN.—Is the residue obtained by boiling the alcoholic extract of galbanum in water. It is dark yellowish-brown, transparent, brittle, and tasteless; soluble in ether and alcohol, scarcely so in spirit containing 50 per cent. of water, or in almond oil. Very slightly soluble in oil of turpentine, even when aided by heat. It dissolves in oil of vitriol, forming a dark yellowish-brown liquid. According to Pelletier, galbanum-resin has the remarkable property of yielding an indigo-blue oil when heated to 248° F. or 266° F. The composition of galbanum resin is, according to Johnston, $C^{40} H^{27} O^{7}$.

PHYSIOLOGICAL EFFECTS. — The general effects of galbanum are those of the fetid antispasmodic gum-resins already described. It is usually ranked between assafœtida and ammoniacum, being weaker than the former but stronger than the latter. As it yields, by distillation, more volatile oil than assafœtida does, it has been supposed that it must exceed the latter in its stimulant influence over the vascular system; but as an antispasmodic, it is decidedly inferior to assafœtida. A specific stimulant influence over the uterus has been ascribed to it: hence the Germans call it *Mutterharz* (i. e. *uterine resin*).

USES. — Galbanum is principally adapted for relaxed and torpid habits, and is objectionable in inflammatory or febrile disorders. It is employed in the same cases as assafœtida, with which it is generally given in combination. It is principally used in chronic mucous or pituitous catarrh, in which it oftentimes proves serviceable. It has also been employed in amenorrhœa and chronic rheumatism. Externally it is applied as a mild stimulant, resolvent, or suppurant, in indolent swellings.

ADMINISTRATION. — It may be given in *substance*, in the form of pill, in doses of from grs. x. to ʒss., or in the form of *emulsion*.

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[1] Mr. E. Solly, *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 144, Lond. 1841.

[2] Pfaff, *Syst. de Mat. Méd.* iii. 294.

[3] *Bull. de Pharm.* iv. 97.

[4] Schwartze, *Pharm. Tabel.* 284, 2te Ausg.

1. **PILULA GALBANI COMPOSITÆ**, L. (Prepared Galbanum, ʒij.; Myrrh, Prepared Sagapenum, each ʒiij.; Prepared Assafœtida, ʒj.; Soft Soap, ʒij.; Treacle, as much as may be necessary. Beat all together that a mass may be formed).—Dose, gr. x. to gr. xx.

2. **EMPLASTRUM GALBANI**, L.; *Emplastrum gummosum*, E.; *Plaster of Galbanum*. (Galbanum, ℥viij.; Plaster of Lead, lb. iij.; American Turpentine, ℥j.; Prepared Frankincense, powdered, ℥iij. Add first the Frankincense, then the Plaster of Lead melted over a slow fire, to the Galbanum and Turpentine melted together, and mix them all, *L.*—"Litharge plaster, ℥iv.; ammoniac, galbanum, and bees' wax, of each ℥ss. Melt the gum-resins together, and strain them: melt also together the plaster and wax: add the former to the latter mixture, and mix the whole thoroughly." *E.*)—This plaster, spread upon leather, is applied to indolent tumours, to promote their suppuration, and to disperse them. Its operation appears to be that of a mild stimulant. It is also applied to the chest in chronic pulmonary complaints. In weakly, rickety children, with weakness of the lower extremities, it is applied to the lumbar region.

[3. **EMPLASTRUM GALBANI COMPOSITUM**, U. S.; *Compound Galbanum Plaster*. Take of Galbanum, ℥viij.; Turpentine, ℥x.; Burgundy Pitch, ℥iij.; Lead Plaster, lb. iij. To the Galbanum and Turpentine, previously melted together and strained, add first the Burgundy pitch, and afterwards the lead-plaster, melted over a gentle fire, and mix the whole together.—ED.]

4. **GALBANUM PRŒPARATUM**, L.—This is directed to be prepared in the same manner as is ordered for the *prepared ammoniacum*.

256. OPOPONAX CHIRONIUM, *Koch.*—THE OPOPONAX.

Pastinaca, Opoponax, *Linn.*

Sex. Syst. Pentandria Monogynia.

(Gummi-resina.)

HISTORY.—Hippocrates[1] employed opoponax (πανάκες). Theophrastus[2] mentions four, and Dioscorides[3] three kinds of πανάκες. The latter of these writers has given a good account of opoponax (ὀποπάναξ), which he says is procured from πανάκες ἡράκλειον.

BOTANY. **Gen. Char.**—Margin of the *calyx* obsolete. *Petals* roundish, entire, rolled inward, with a rather acute lobe. *Stylopodium* broad, thick. *Styles* very short. *Fruit* flattened at the back, with a dilated convex margin. *Mericarps* [half-fruits] with three dorsal, filiform, very thin ridges, and no distinct lateral ones. *Vittæ* 3 to each channel, 6 to 10 to each commissure. *Seed* smooth.—Perennial *herb*. *Root* thick. *Stem* rough. *Leaves* bipinnatisect; segments unequally cordate, crenate, obtuse. *Umbels* compounded of many rays. General and partial *involucre* few-leaved. *Flowers* yellow (De Cand.)

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[1] *Opera*, p. 402, ed. Fœs.

[2] *Hist. Plant.* lib. ix. c. 12.

[3] Lib. iii. cap. 55-7.

Sp. Char.— The only species.— A plant six or seven feet high, resembling the parsnip.

Hab.— Sunny parts of the south of France, Italy, Sicily, Croatia, and Greece.

EXTRACTION.— According to Dioscorides, whose account is probably correct, this gum-resin is obtained by incisions into the root; a milky juice exudes, which, by drying, becomes yellow, and forms opoponax.

DESCRIPTION.— Opoponax (*gummi opoponax*) occurs in irregular yellowish-red lumps (*opoponax in massis*), or in reddish tears *opoponax in lachrymis*). It has an acrid bitter taste, and an unpleasant odour. Rubbed with water it forms an emulsion. Its general properties as a gum-resin have been already noticed.

COMPOSITION.— Opoponax has been analysed by Pelletier.[1] He found the constituents to be—

Resin	42·0
Gum	33·4
Starch	4·2
Extractive	1·6
Wax	0·3
Malic acid	2·8
Lignin	9·8
Volatile oil, traces of caoutchouc, and loss	5·9
Opoponax	100·0

RESIN.— Reddish-yellow; fusible at 122° F. Soluble in alkalies, alcohol, and ether. The alkaline solution is reddish: the resin is precipitated from it by hydrochloric acid, in the form of yellow flocks. Nitric acid acts freely on the resin. Its composition, according to Johnston, is, $C^{40}H^{25}O^{4}$.

PHYSIOLOGICAL EFFECTS.— Similar to the other fetid, antispasmodic gum-resins. It is, perhaps, more allied to ammoniacum than to any other of these substances.

USES.— Opoponax is rarely employed. It is adapted to the same cases as the other gum-resins of this class.

257. CONIUM[2] MACULATUM, *Linn.*—THE COMMON OR SPOTTED HEMLOCK.

Sex. Syst. Pentandria Digynia.

Folia, *L. E. D.*

HISTORY.—This plant is usually supposed to be the κώνειον of the Greek writers,—the celebrated *Athenian state poison*, by which Socrates[3] and Phocion[4] died,—and the *cicuta* of the Roman authors. Various reasons contribute to give the common opinion on this point a high degree of probability. Dioscorides[1] described the plant sufficiently well to prove it must have been one of the Umbelliferæ; and he tells us that it had a heavy odour, and a fruit like that of anise. The latter simile applies to our Conium, for a very intelligent druggist mistook, in my presence, the fruit of the hemlock for that of anise; and at the examination for M.B. at the University of London, 1839, a considerable number of the candidates, to whom the hemlock fruit was shown, made the same mistake. Dioscorides also tells us that the χώνειον of Crete and Megara was the most powerful, and next to this came that of Attica, Chio, and Cilicia. Now Dr. Sibthorp[2] found Conium maculatum growing near Constantinople, not unfrequently in the Peloponnesus, and most abundantly between Athens and Megara. So that the locality of our Conium agrees, as far as has been ascertained, with that of the ancient plant. Moreover, Conium maculatum is at this present time called by the Greeks χώνειον.[3] We may gather from the poetical account of the effects of χώνειον given by Nicander,[4] that this plant "brings on obliteration of the mental faculties, dimness of sight, giddiness, staggering, stifling, coldness of the limbs, and death by asphyxia; a view of its effects," says Dr. Christison,[5] "which differs little from the modern notions of the poisonous action of the spotted hemlock." It is also remarkable that the ancients regarded χώνειον as having the power of discussing tumours—a virtue which has been assigned to hemlock by writers of the present day.

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[1] *Bull. de Pharm.* iv. 49.

[2] This word is sometimes incorrectly accented *co'nium*. But "those words which, in Greek, are written with *ei* before a vowel, and in Latin with *e* or *i*, have the *e* or *i* long; as *Ænēas, Cassiopēa, Cytharēa, Centaurēa*," &c. (Grant's *Institutes of Latin Grammar*, 2d edit. p. 343 1823).

[3] *Works of Plato*, by T. Taylor, vol. iv.; *The Phædo*, p. 340.

[4] Plutarch's *Lives*.

I am fully aware that the characters of the ancient plant, as given us by Dioscorides and Pliny,[6] are insufficient to distinguish it from some other Umbelliferæ; yet I think the evidence of its being our Conium maculatum is deserving of much greater confidence than Dr. Christison is disposed to give it. The absence of all notice, in the writings of the ancients, of the purple spots on the stem, has been urged against the probability of this opinion. "Pliny's term *nigricans*, applied to the stem, is but a feeble approach," says Dr. Christison, "to the very remarkable character of the modern plant, the purple-spotted stem." But in 1839 I showed to the pupils attending my lectures a stem of hemlock to which the term *blackish* might be applied without greater impropriety of language than is daily made use of when a man is said to have a black eye; for the dark purple spots had coalesced so as to cover most completely the lower part of the stem. Admitting, however, that the term is not strictly correct, I would observe, first, that there is no poisonous umbelliferous plant to which it applies so well as to hemlock; and, secondly, Dioscorides and Pliny may be well excused for using it, seeing that a distinguished toxicologist described the spots on the stem as *blackish.*[7]

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[1] Lib. iv. cap. 79.

[2] *Prodr. Fl. Græcæ*, i. 187.

[3] Ελληνικη Φαρμακοποιΐα, 1837.

[4] *Alexipharmaca*, f. 34-5, Paris, 1549.

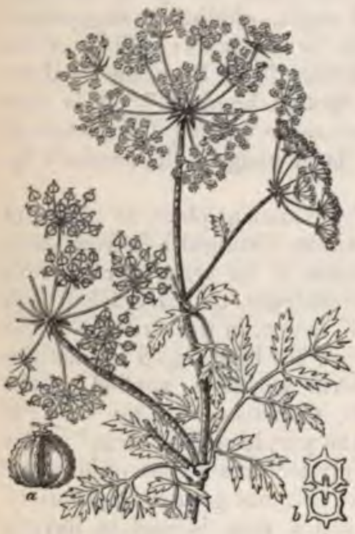
[5] *Transactions of the Royal Society of Edinburgh*, vol. xiii.

[6] *Hist. Nat.* lib. xxv. cap. 95, ed. Valp.

[7] See Orfila, *Toxicol. Gén.* ii. 299, 1818. [In a later edition of his Toxicology (1843), Orfila describes the stem of the plant as "offrant des taches d'une couleur pourpre foncée." *Toxicologie*, ii. 422, 1843.—ED.]

It is evident that our generic term *Conium* is derived from the Greek word κώνειον. Linnæus has been censured by Lamarck for using this name, since the Latin authors call our hemlock *Cicuta*, which he, therefore, contends ought to be its designation now. But it should be remembered that Linnæus has only restored its ancient name, for the word Cicuta is unknown to the Greek language. By modern botanists the latter term is applied to a distinct genus of plants; and when, therefore, we meet with it in botanical works, we must not confound it with the cicuta of the Romans. Especially careful should the student be not to confound *Conium maculatum* with *Cicuta maculata.* It is certainly much to be regretted that such a ground of confusion should exist, but I am afraid it is now too late to obviate it.

Fig. 42.



Conium Maculatum.
(*Hemlock.*)

Botany. **Gen. Char.**—Margin of the *calyx* obsolete. *Petals* obcordate, somewhat emarginate, with a very short inflexed lobe. *Fruit* compressed at the side, ovate. *Mericarps* [half-fruits] with 5 prominent, undulated, crenulated, equal ridges, the lateral ones marginal. *Channels* with many striæ, but no vittæ. *Carpophorus* bifid at the apex. *Seed* incised with a deep narrow groove, and confounded with it.—European, biennial, poisonous *herbs.* *Root* fusiform. *Stem* round, branched. *Leaves* decompound. Both partial and general *involucres*, 3- to 5-leaved; partial one, halved. *Flowers* white, all fertile (De Cand.)

Sp. Char.—Leaflet of the partial *involucre* lanceolate. Partial *umbel* short (De Cand.)

Root biennial, tap-shaped, fusiform, whitish, from 6 to 12 inches long, somewhat resembling a young parsnip. *Stem* from 2 to 6 feet high, round, smooth, glaucous, shining, hollow, spotted with dark purple. *Leaves* tripinnate, with lanceolate, pinnatifid leaflets, of a dark and shining green colour, smooth, very fetid when bruised, with long, furrowed footstalks, sheathing at their base. *Umbels* of many general as well as partial rays. *General involucre* of several (usually 3 to 7) leaflets; *partial involucre* of 3 leaflets on one side. Margin of *calyx* obsolete. *Petals* 5, obcordate, white, with inflexed points. *Stamina* 5, epigynous, as long as the petals. *Ovarium* ovate, 2-celled, striated; *styles* 2, filiform, spreading; *stigma* round. *Fruit* ovate, compressed laterally; *mericarps* [half-fruits] with 5 primary, but no secondary, ridges, which are undulato-crenated; the channels have many striæ, but no vittæ. *Seed* with a deep, hollow groove in front.

Hab.—Indigenous; hedges and waste ground, especially near towns and villages. In other parts of Europe, the East of Asia, and in the cultivated parts of North America and Chili, into which it has been introduced.

In distinguishing Conium maculatum from other Umbelliferæ, the following characters should be attended to:—The large, round, smooth, spotted *stem*; the smooth, dark, and shining green colour of the lower *leaves*; the *general involucre* of from 3 to 7 leaflets; the *partial involucre* of 3 leaflets; the *fruit* with undulated, crenated, primary ridges. To these must be added, that the whole *herb*, when bruised, has a disagreeable smell (compared by some to that of mice, by others to that of fresh cantharides, or of cats' urine).

The indigenous Umbelliferæ most likely to be confounded with Conium maculatum are, *Æthusa Cynapium* and *Anthriscus vulgaris*. ÆTHUSA CYNAPIUM, or *Fool's Parsley*, is distinguished from hemlock by its smaller *size*, by the absence of the strong disagreeable smell which distinguishes the *leaves* of hemlock, by the want of a *general involucre*, by the 3 long, narrow, unilateral, pendulous leaflets composing the *partial involucre*, by the *ridges* of the fruit being entire (*i. e.* not undulate or crenate), and by the presence of *vittæ*. ANTHRISCUS VULGARIS, or *Common Beaked-Parsley*, is known from hemlock by the paler colour and slight hairiness of the *leaves*, by the absence of spots on the *stem*, by the swelling under each joint, by the absence of a *general involucre*, by the roughness of the *fruit*, and by the absence of a strong unpleasant odour when the *leaves* are bruised. ANTHRISCUS SYLVESTRIS (*Chærophyllum sylvestre*), or *Common Cow-Parsley*, is scarcely likely to be confounded with hemlock. The stem, though purplish, is striated, downy at the lower part, and slightly swollen below the joint; the leaves are rough-edged; there is no general involucre; and the partial one usually consists of 5 or more leaflets.

DESCRIPTION.—The leaves (*folia conii*) only are officinal. They should be gathered from wild plants, just before the time or at the commencement of flowering. If intended for drying, the larger stalks should be removed, and the foliaceous parts quickly dried in baskets by the gentle heat (not exceeding 120° F.) of a proper stove. Exclusion from solar light contributes greatly to the preservation of the colour. If properly dried, the leaves should have a fine green colour, and their characteristic odour; and when rubbed with caustic potash they should evolve the odour of conia. They should be preserved in cool, closed, perfectly opaque, and dry vessels. Tin canisters possess these properties. However, no reliance can be placed on the dried leaves, however carefully prepared, for they sometimes yield no conia, though they possess the proper hemlock odour and a fine green colour. If the fresh leaves be subjected to pressure, they yield a greenish juice (*succus conii*) from which, on standing, a *green fecula* subsides. The fruit, commonly termed *hemlock seeds* (*fructus seu semina conii*), has very little odour, and a slight, somewhat bitterish taste. It retains for a much longer time than the leaves its active principle unchanged (see *Conia*).

COMPOSITION.—Schrader[1] made a comparative analysis of wild and cultivated hemlock, but with no important result. He also made a comparative examination of hemlock and cabbage (*Brassica oleracea*), the only curious part of which was, that he found a striking resemblance between them.[2] Peschier[3] found in hemlock a salt which he called *coniate of conia*, being composed of a peculiar crystallisable acid (*coniic acid*, or coneic acid), and a peculiar base. Hemlock juice was analysed by Bertrand;[4]

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[1] *Berlin. Jahrbuch*, 1805, S. 152.

[2] Schweigger's *Journ. für Chem.* Bd. v. S. 19, 1812.

[3] Pfaff, *Syst. d. Mat. Med.* Bd. vii. S. 300; Berzelius, *Traité de Chim.* vi. 254.

[4] *Recueil de Mém. de Méd. de Chir. et de Pharm. Mil.* t. ix. p. 300.

the leaves by Dr. Golding Bird;[1] the ashes by Brandes.[2] An analysis of hemlock (leaves?) by the last-mentioned chemist is quoted by Mérat and De Lens.[3] Peschier and Brandes first announced the existence, in this plant, of a peculiar basic principle, which Giseke,[4] in 1827, obtained in combination with sulphuric acid. But Geiger,[5] in 1831, procured it, for the first time, in an isolated form, and described some of its properties and effects on animals. It was afterwards examined by Dr. Christison,[6] and by MM. Boutran-Charlard and O. Henry.[7]

Schrader's Analysis.

	Hemlock.		Cabbage.
Extractive	2·73	...	2 34
Gummy extractive	3·52	...	2·89
Resin	0·15	...	0·05
Vegetable albumen	0·31	...	0·29
Green fecula	0·80	...	0·63
Water, with acetic acid and various salts	92·49	...	93·80
Total	100·00		100 00

Brandes's Analysis.
Peculiar basic principle (*conicine*).
Very odorous oil.
Vegetable albumen.
Resins.
Colouring matter.
Salts.
[Lignin and water].
Hemlock.

1. VOLATILE OIL OF HEMLOCK (*Odorous principle*).—The distilled water of hemlock possesses, in a high degree, the characteristic odour of hemlock, but is scarcely, if at all, poisonous. Hence it is obvious that the odorous matter is not the active principle. Furthermore it shows that the characteristic odour of hemlock, in the different preparations of this plant, is not to be taken as a necessary indication of their activity. Bertrand isolated the odorous matter, and found it to be a volatile oil of an acrid taste and peculiar odour.

2. CONIA $\overset{+}{Co}$ (*Conicine*; *Conein*; *Cicutine*).—Exists in hemlock in combination with an acid (*coniic acid*, Peschier); so that it cannot be recognised by its odour, nor obtained by distillation, without the assistance of an alkali. It exists, probably, in all parts of the plant, but is more copious in the fruit than in the leaves; and, most remarkably, it may be preserved for a much longer time in the former than in the latter. Geiger procured from 6 lbs. of fresh, and 9 lbs. of dried fruits, about one ounce of conia; whereas from 100 lbs. of the fresh herb he obtained only a drachm of this alkaloid. He could get traces only of it in fresh-dried leaves, while he extracted a drachm of it from nine ounces of the fruit which had been preserved (not very carefully) for sixteen years. This by no means agrees with my own observations and experiments; for I have found that fruit which has been kept for three years yielded only a very minute portion of conia; though from the same sample, when fresh gathered, I had obtained a considerable quantity. From 40 lbs. of the ripe, but green, seeds (mericarps), Dr. Christison obtained two ounces and a half of hydrated conia. Conia, free from all impurity but water, may be obtained by distilling the alcoholic soft or syrupy extract of the seeds (mericarps) with its own weight of water and a little caustic potash. The conia passes over readily, and floats on the surface of the water (which contains conia in solution). When pure, conia is at ordinary temperatures an oily-looking, transparent liquid, lighter than water; sp. gr. 0·89, but according to Blyth 0·878. Its odour is strong, penetrating, and stupefying, somewhat like that of hemlock, or more analogous to a combination of the odours of tobacco and mice. Its vapour excites a flow of tears. Its taste is acrid, somewhat resembling that of tobacco.

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[1] *Lond. Med. Gaz.* xi. 248.
[2] *Berlin. Jahrbuch*, 1819, S. 116.
[3] *Dict. de Mat. Méd.* ii. 391.
[4] *Journ. de Pharm.* xiii. 366.
[5] *Mag. für Pharm.* xxxv. 75 and 259.
[6] *Trans. Roy. Soc. Edinb.* vol. xiii.; and *Lond. Med. Gaz.* xviii. 123.
[7] *Journ. de Chim. Méd.* t. ii. 2nde sér. p. 530.

[Conia is not very soluble in water, and it possesses the remarkable property of being more soluble in cold than in hot water. At common temperatures, 100 parts of water dissolve one part of conia: the solution becomes turbid when warmed. The aqueous solution is rendered brown by exposure to air, and deposits a brown resinous-looking mass. It is soluble in alcohol in all proportions — also in acetone. The alcoholic solution of conia combines with water more readily than the pure alkaloid, and one part of conia dissolved in four parts of alcohol is not rendered turbid by the addition of water. One part of conia is soluble in six parts of ether. Conia is volatile, and when dropped on paper produces a transparent greasy-looking stain like an essential oil. By a gentle warmth the stain entirely disappears; if slowly evaporated, there is a brown colour produced. The boiling point of conia is variously given. According to Christison it is 370°. Ortigosa fixes it at 413°, Geiger at 302°, and Blyth at 338°. In close vessels it passes over without decomposition, and when mixed with water, its vapour may be distilled over at 212°. These differences in the boiling point have probably arisen from the variable degrees of purity of the conia. It combines with one-fourth of its weight of water, forming *hydrate of conia.*

When heated in air it burns with a bright smoky flame. Albumen is coagulated by it. It readily dissolves sulphur, but appears to exert no action on phosphorus. It acquires a blood-red colour on the addition of a small quantity of nitric acid: on adding a larger quantity of acid, great heat is given out,—nitrous acid is evolved, and the colour changes to orange. By distilling conia with nitric acid, butyric acid is one of the products of the oxidation of the alkaloid:—

$$\underbrace{C_{17}H_{17}N}_{\text{Conia}} + O_8 = {}_2\underbrace{C_8H_7O_3}_{\text{Butyric Acid.}} + NH_3 + CO_2$$

When strong sulphuric acid is added to conia, much heat is evolved, and the liquid acquires a purple-red colour, passing subsequently to olive-green. Dry hydrochloric acid gas at first produces with it a purple-red tint, and this changes to an indigo-blue.

Anhydrous conia has no alkaline reaction, but on the addition of a small quantity of water its alkalinity is strongly and permanently manifested. It produces copious white fumes with the vapours of nitric, hydrochloric and acetic acids, and completely neutralises these acids. The salts of conia are procured by neutralising the alkaloid with diluted acids, and afterwards evaporating the solutions *in vacuo.* They crystallise with difficulty, and only partially *in vacuo;* in the anhydrous state they are without odour,—when moistened they evolve a diluted smell of conia: their taste is acrid and disagreeable,—their action poisonous, but they are less energetic than the pure alkaloid, which produces powerful effects in doses varying from one-eighth of a grain to a grain. The salts of conia are deliquescent and very soluble in water,—they are also dissolved by alcohol and alcoholic ether: but in pure ether they are insoluble. They are destroyed by heat, and when treated with the fixed alkalies, a stupefying smell of conia is evolved. The aqueous solutions of the salts are decomposed at common temperatures when exposed to air, acquiring at first a violet, then a red, and afterwards a dark green or blue colour. The decomposition, however, is only partial, since alkalies destroy the colour and bring out the smell of conia. If evaporated under exposure to air, the aqueous solutions are decomposed: they acquire a dark colour, and simultaneously with the production of an ammoniacal salt a brownish-coloured flocculent matter is precipitated.

The change is similar to that produced in pure conia or its aqueous or alcoholic solution when exposed to air. The alkaloid is resolved into ammonia, and a bitter extractive matter possessed of no poisonous properties. This tendency to spontaneous change, which is materially increased by temperature, may account for the variable proportion of the active principle found in some preparations of hemlock, as also for the conflicting accounts of authors regarding their medicinal action.

Conia is a strong base, and resembles ammonia (to which it is connected by decomposition) in many of its reactions. It precipitates oxide of silver from the nitrate, and redissolves it when added in excess. Chloride of silver is almost as soluble in it as in ammonia.

Conia has been introduced into the *Pharmacopœia Norvegica* under the name of *Coniinum.* The average medicinal dose is stated to be from the one fortieth to the one sixtieth part of a grain. A dose of the twentieth part of a grain might be attended with dangerous consequences.—ED.]

Conia is characterised by its liquidity at ordinary temperatures, its volatility, its peculiar odour, its reddening turmeric paper, its vapour forming white fumes (*hydrochlorate of conia*] with the vapour of hydrochloric acid, its solution in water forming, with infusion of nutgalls, a white precipitate (*tannate of conia*), its sulphate and other salts being deliquescent and soluble in alcohol, its not being reddened by either nitric or iodic acids, and lastly, by its alcoholic solution not being precipitated by the alcoholic solution of carbazotic acid. Several of the *salts of conia* are crystallisable. When solutions of them are evaporated, they lose a part of their base, the odour of which becomes sensible. The nitrate of conia, when decomposed by heat, yields brown pyrogenous products. The solution of hydrochlorate, when evaporated in air, becomes first purple, then deep blue. Potash added to a salt of conia sets the base free, which is then recognised by its odour.

Liebig analysed conia. Its constituents are: —

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Liebig.*
Carbon	12	72	66·67	66·913
Hydrogen	14	14	12·96	12·000
Nitrogen	1	14	12·96	12·805
Oxygen	1	8	7·41	8·282
Conia	1	108	100·00	100·000

[The author has here adopted the analysis of Liebig. According to Ortigosa the formula of conia is $C_{17}H_{16}N$, and the results obtained by Blyth and Wurtz are in accordance with the view that conia contains no oxygen. Blyth assigns the formula $C_{17}H_{17}N$, and Wurtz $C_{16}H_{15}N$ or $C_{16}H_{12}NH_3$. It is probable that the substance hitherto described as conia is a product, or if an educt, it is liable during extraction to changes affecting its chemical constitution and properties.—ED.]

The *effects* of conia have been tried on mammals (the dog, cat, rabbit, and mouse), birds (pigeon, kite, and sparrow), reptiles (slow-worm), amphibials (the frog), annelides (earth-worm), and insects (fly and flea). One drop placed in the eye of a rabbit killed it in nine minutes; three drops employed in the same way killed a strong cat in a minute and a half; five drops poured into the throat of a small dog began to act in thirty seconds, and in as many more motion and respiration had entirely ceased. [It does not dilate the pupil.—ED.]

The following are the symptoms produced, as detailed by Dr. Christison: — "It is, in the first place, a local irritant. It has an acrid taste; when dropped into the eye, or on the peritoneum, it causes redness or vascularity; and to whatever texture or part it is applied, expressions of pain are immediately excited. But these local effects are soon overwhelmed by the indirect or remote action which speedily follows. This consists essentially of swiftly-spreading palsy of the muscles, — affecting first those of voluntary motion, then the respiratory muscles of the chest and abdomen, lastly the diaphragm, and thus ending in death by asphyxia." Convulsive tremors, and twitches of the limbs, sometimes, though not invariably, are observed. The external senses do not appear to be affected until respiration is impaired. If a rabbit be lifted up by his ears when under the influence of the poison, he makes the same kind of struggles to be released that he does when in health. So also if we place him in an uneasy posture, he makes attempts to alter his position, proving that his senses are unimpaired. After death the muscles are susceptible of the galvanic influence. MM. Boutran-Charlard and O. Henry state, that most of the animals to whom they gave conia became "a prey to the most dreadful convulsions. The plaintive cries, the contortions, and the rigidity of the limbs, which have always preceded death, leave no doubt as to the cruel pains which this kind of poisoning brings on." This account agrees neither with my own observations, nor with those published by Dr. Christison.

Does conia become absorbed? In favour of the affirmative view of this question may be mentioned the fact, that this alkali acts on all the textures admitting of absorption; and that the quickness with which the effects occur are in proportion to the absorbing power of the part. But the rapidity of its action, when introduced into the veins, is a barrier to the supposition of its acting on the nervous centres by local contact; for Dr. Christison states, that two drops, neutralised by dilute muriatic acid, and injected into the femoral vein of a young dog, killed the animal in two or three seconds at farthest.

The primary seat of the action of conia is probably the spinal cord. In this, conia and strychnia agree; but in the nature of the effect they seem, as Dr. Christison has observed, to be the counterparts of each other. Conia exhausts the nervous energy of the cord, and causes muscular paralysis; strychnia irritates it, and produces permanent spasm of the respiratory muscles. It is evident, therefore, that, like strychnia and nux vomica, its operation is on the seat of the reflex functions, which, according to Mr. Grainger,[1] is the grey matter of the spinal cord.

These effects of conia suggest its employment in convulsive or spasmodic diseases; as tetanus, poisoning by strychnia, brucia, or nux vomica, hydrophobia, &c. I have tried it on two rabbits under the influence of strychnia, and found that it stopped the convulsions, but hastened rather than prevented death. In September, 1838, it was tried in a case of hydrophobia at the London Hospital. The following is a brief report of the case: — "In the case of hydrophobia, in a middle-aged man, after the disease was fully formed, two minims of conia, dissolved in thirty drops of acetic acid, were applied endermically to the præcordium (the cuticle being previously removed by a blister). The effects were instantaneous. The pulse fell from 64 to 46, and became more regular. The vomiting and convulsions ceased; the respiration became less difficult, and the symptoms of the disease appeared to be altogether mitigated. The man expressed himself as feeling much better, and entertaining hopes of an ultimate recovery. These effects were, however, but transitory, and in about seven minutes the symptoms began to reappear, and shortly assumed their previous urgency. Three minims of conia were injected into the rectum about a quarter of an hour after the endermic application of it, but it produced no effect in allaying the symptoms of the disease. The remedy was not repeated, and the man became rapidly worse, and died in a few hours." The properties of conicine have been recently examined by Orfila.[2]

[M. Devay considers that conia used both internally and externally is of great service in chronic enlargements of the lymphatic glands, and in hypertrophy of the body and neck of the uterus, and that it is more useful for the cure (*qu.* relief) of cancer, than any other remedy, especially if employed after the tumour has been removed by operation, when it often appears to prevent a return of the disease.[3]—ED.]

3. EMPYREUMATIC OIL OF HEMLOCK (*Pyro-conia?*).—This oil, obtained by the destructive distillation of hemlock, resembles, according to Dr. Morries,[4] that procured from foxglove.

CHARACTERISTICS FOR MEDICO-LEGAL PURPOSES.—Hemlock can only be properly recognised by its botanical characters, already described: yet its remarkable odour may sometimes be of considerable assistance in recognising the plant or its preparations; nor is the fact to be lost sight of, that a solution of potash rubbed with the leaves or fruit developes a strong smell of conia. In some cases it might be possible to obtain conia by distilling the alcoholic extract of the suspected substance with water and caustic potash.

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—Marcet placed a haricot plant (*Phaseolus vulgaris*) in a solution of five grains of the extract of hemlock. In a few minutes the two lower leaves curled at their extremities; the next day they were yellow, and subsequently died.[5] Schübler and Zeller[6] also confirm its poisonous operation.

β. On Animals generally.—The effects of hemlock on animals have been tried by Harder,[7] Wepfer,[8] Orfila,[9] and Schubarth.[10] The animals experimented on were the dog, wolf, rabbit, and guinea-pig. The action of hemlock on the solipedes and ruminants is very much less energetic than on the carnivora. Moiroud[1] has given three pounds and a half of the plant to a young horse without inconvenience; but in another instance the decoction of four ounces proved fatal. It caused dejection, stupor, dilatation of the pupils, trembling, salivation, nausea, spasmodic contraction of the muscles of the extremities, rolling of the eye, grinding of the teeth, and copious cold sweats. From the observations of Orfila, hemlock is a local irritant (though this action was not constantly observed), and produces giddiness, convulsions, loss of sensibility, palsy, and coma. This account, as Dr. Christison observes, does not agree with the symptoms induced by conia, which does not seem to affect the senses so long as the respiration goes on. "But it is possible," he adds, "that the difference is more apparent than real, and that hemlock has been supposed to extinguish sensation, merely because by inducing paralysis it takes away the power of expression; at least in some experiments I have made, sensation did not appear to be affected; and the whole phenomena were identical with those produced by conia. In these experiments I used very strong extracts, prepared by absolute alcohol from the fresh leaves or full-grown seeds; and each of them occasioned, in doses of thirty grains or thereabouts, paralysis of the voluntary muscles, with occasional slight convulsions, then paralysis of the respiratory muscles of the chest and abdomen, and finally cessation of the action of the diaphragm. Sensation appeared to continue so long as it was practicable to make an observation on the subject: and the heart contracted vigorously for a long time after death." But from the united observations of the effects of hemlock on animals and man, I cannot help suspecting, either that this plant contains a second active principle, whose operation is somewhat distinct from conia, or that the influence of this alkaloid is greatly modified in the plant by combination with other matters.

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[1] *Observations on the Struct. and Funct. of the Spinal Cord.*

[2] See his paper in *Annales d'Hygiène*, 1851, ii. p. 147.

[3] *Annuaire de Thérapeutique*, 1853, p. 68.

[4] *Ed. Med. and Surg. Journal*, xxix. 377.

[5] *Ann. Chim. et Phys.* xxix. 219.

[6] Schweigger's *Journ. f. d. Chem.* Bd. i. S. 54.

[7] Boneti, *Sepulchr.* l. iv. sect. x. obs. iv. p. 488.

[8] *Hist. Cicut. aquat.* p. 201, 1733.

[9] *Toxicol. Gén.* ii.

[10] Wibmer, *Wirk. d. Arzneim. u. Gifte*, ii. 169.

γ. *On Man.*—In *small* or *medicinal* doses, hemlock has been frequently administered for a considerable period, with obvious relief, in certain diseases (tumours of various kinds, for example), without any other evident effect; hence the statement of some authors, that hemlock acts insensibly on the system. "It seldom purges," says Storck,[2] "and very rarely vomits. Sometimes it increases perspiration, and often it occasions a copious discharge of viscid urine. In many patients, nevertheless, it does not sensibly augment any of the secretions." Long-continued use, especially if the doses be increased, will sometimes occasion disorder of the digestive organs or of the nervous system, dryness of the throat, thirst, and occasionally, it is said, an eruption on the skin. Choquet[3] mentions the case of a man who gradually increased the dose of the extract to half a drachm; it produced slight delirium and syncope, which obliged him to suspend its use. The ancients were of opinion that hemlock exercised a specific influence over the breasts and testicles. "It extinguishes the milk," says Dioscorides, "and prevents the development of the mammæ of virgins; moreover, in boys it causes wasting of the testicles." Pliny gives a similar account of it, and adds, "it reduces all tumours." The same notions of its effects seem to have been entertained by the Arabians; for Avicenna praises it as a remedy for tumours of the breasts and testicles. More recently,[1] somewhat similar effects on the breasts have been ascribed to it. In two cases it is said to have caused atrophy of the mammæ.

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[1] *Pharm. Vét.* 359.

[2] *Essay on Hemlock*, Eng. tr., 2d edit. 1762.

[3] Orfila, *Toxicol. Gén.* ii. [not mentioned in later editions.—ED.]

In *large* or *poisonous doses* the symptoms are those indicating disorder of the cerebro-spinal functions. In some of the best recorded cases the leading symptom was coma; the effects being altogether analogous to those of opium. In other instances, convulsions or violent delirium, or both, were the prominent symptoms. As an illustration of the *comatose condition* sometimes brought on by this poison, I shall quote a case recorded by M. Haaf, a French army surgeon, and which occurred to him while in garrison at Torrequemada, in Spain, in March, 1812.[2] A soldier having eaten of some broth into which hemlock had been put, went to sleep immediately after his supper. In an hour and a half he was found groaning and breathing with difficulty; in consequence of which M. Haaf was sent for. He found his patient in a profound sleep, without sense, respiring with difficulty, and lying on the ground. His pulse was 30, small and hard; the extremities cold; the face bluish, and distended with blood, like that of a person strangled. Twelve grains of emetic tartar were given, and occasioned some fruitless attempts to vomit. He became gradually worse, had violent palpitations of the heart, and died in three hours after his fatal supper. Several other cases in which *coma* was the leading symptom might be quoted, but the one just related is the best.

We have no well-detailed cases in which *delirium* was the leading symptom. The following must suffice, by way of illustration; it is from Kircher:[3]—Two priests ate hemlock root by mistake; they became raving mad, and mistaking themselves for geese, plunged into the water. For three years they suffered with partial palsy and violent pain. Orfila also mentions a vine-dresser and his wife, who became mad and furious from hemlock.

General *paralysis* has also been observed in this form of poisoning. A case in which this was a most prominent symptom is mentioned by Alderson.[4] An overdose of Conium maculatum "produced general paralysis: the under jaw fell, the saliva ran from the patient's mouth, the urine dropped from the bladder, and the contents of the rectum were discharged; in short, every voluntary muscle lost its energy, and the patient continued for nearly an hour in this most deplorable state, unable to move or to command the slightest exertion, though all the time perfectly sensible." He recovered by the use of stimulants.

As illustrations of the *convulsions* caused by hemlock, I may refer to the cases mentioned by Limprecht and Ehrhard.[5] The first states that an old woman suffered for three months with abdominal pain and convulsive movements of the limbs, in consequence of eating hemlock root. Ehrhard mentions trismus as one of the symptoms in another case. Dr. Watson[6] has related two cases in which giddiness, coma, and convulsions occurred. These statements, as well as others of a like tendency which might be quoted, do not agree with the (as yet) ascertained effects of conia.

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[1] *Lond. Med. Gaz.* viii. 125.
[2] Orfila, *Toxicol. Gén.* ii. p. 426, ed. 1843.
[3] Wibmer, *Wirk.* &c. ii. 172.
[4] *An Essay on the Rhus Toxicodendron*, p. vi. Hull, 1811.
[5] Wimber, *op. cit.*
[6] *Phil. Trans.* vol. xliii. No. 473, p. 18.

The *post-mortem* appearances throw but little light on the *modus operandi* of hemlock. Venous congestion, especially of the cerebral vessels, a fluid condition of the blood, and, in the lower animals, redness of the alimentary canal, are the occasional appearances.

USES. — In the present state of uncertainty with respect to the real physiological operation of hemlock, it is obviously impossible to lay down indications or contra-indications for its use, which can be much relied on. Acute inflammation, fever, apoplexy, or tendency to it, and paralysis, are among the circumstances which oppose the employment of hemlock.

The uses of hemlock may be reduced to two heads: those which depend on its influence over the organic functions; and, secondly, those which have reference to its influence over the cerebro-spinal system. The resolvent or discutient and alterative uses come under the first head; the antispasmodic and anodyne under the second.

1. *As a resolvent or discutient and alterative.* — Under the continued use of small and repeated doses of hemlock, glandular and visceral enlargements have frequently subsided; hence has arisen the opinion, entertained in all ages, of the resolvent and discutient powers of this remedy, and of the stimulus which it communicates to the absorbing vessels. The mammæ and the skin are the parts in which these powers have been supposed to be more especially manifested; and the asserted effects (wasting of the breast, profuse sweating, and eruptions) of hemlock on these parts, in healthy individuals, lend support to this opinion. But the influence of hemlock over the organic functions does not appear to be limited to this resolvent operation. In foul ulcers the quality of the discharge has been greatly improved, while pain has been alleviated, and the tendency of the sores to spread has apparently been greatly diminished. If, then, these effects be really referable to hemlock (and they have been asserted by so many writers, in all ages, that we can scarcely refuse to admit them), they prove that this plant exercises a most profound influence over nutrition and the other organic functions, and which we have no better term to indicate than that of alterative. But so frequently has this influence failed to manifest itself, especially in those cases where it was most desired, that a very proper doubt has prevailed among practitioners of the present day, whether it really exists, and whether those phenomena which have been supposed to indicate it, are not really referable to other influences and circumstances. That hemlock has some influence of the kind referred to, I do not doubt; but it has been greatly exaggerated, and thereby much unmerited discredit has been brought on the remedy: for practitioners, finding that it would not do all that had been ascribed to it, have frequently dismissed it as altogether useless. Whether the failures ought, in part at least, to be ascribed to imperfect modes of preparing and administering this plant, we are, as yet, unable positively to affirm. One fact, however, is certain, that many of the preparations of hemlock in ordinary cases are inert, or nearly so; and others, probably, have had their properties greatly changed in the process of their preparation. The remark made by Dr. Christison, with respect to the physiological effects of this plant, applies well to the point under discussion. "If," says this writer, "physicians

or physiologists would acquire definite information as to the physiological effects of hemlock, in small or medicinal doses, they must begin the inquiry anew. Little importance can be attached to any thing already done in this field, as I have no doubt whatever that by far the greater proportion of the preparations of hemlock hitherto employed has been of very little energy, and, in the doses commonly used, is absolutely inert."

The diseases to which the preceding remarks especially apply, are, *enlargements and indurations of the absorbing and secreting glands* and *of the viscera*, *scrofula*, *obstinate chronic skin diseases*, and *foul ulcers*. I am not prepared to offer any opinion, as to whether the diseases to which the terms *scirrhus* and *cancer* are strictly applicable, have ever been cured by hemlock. One fact is undoubted, that diseases, supposed to have been scirrhous and cancerous, have been greatly alleviated, and, in some cases, apparently cured, by this remedy. This fact does not rest on the sole testimony of Storck,[1] but on that of a multitude of practitioners.[2] Bayle has collected, from various writers, forty-six cases of cancerous diseases, said to have been cured, and twenty-eight ameliorated, by hemlock. In *scrofula*, in which disease Fothergill,[3] and many others,[4] have praised it, it seems to be occasionally useful as a palliative in irritable constitutions. It allays the pain, and assists in reducing the volume of enlarged lymphatic glands, and in scrofulous ulcerations improves the quality of the discharge, and disposes the sores to heal. Even *enlargements of the liver*, *spleen*, and *pancreas*, have been, at times, apparently, benefited by hemlock. In *mammary tumours* and *profuse secretion of milk* (*galactorrhœa*), a trial of it should never be omitted. In *bronchocele* it has been found efficacious by Dr. Gibson, Professor of Surgery in the University of Pennsylvania.[5] In *syphilis* it is useful, by alleviating nocturnal pains, and in diminishing the tendency to spread of irritable sores.[6] In *chronic skin diseases* (lepra, herpes, &c.) it is now but rarely employed.

2. *As a cerebro-spinal agent* (*antispasmodic and anodyne*). The power possessed by conia of paralysing the motor nerves, suggests the employment of hemlock as an *antispasmodic*. Hitherto, however, trials of it have been made in a few spasmodic diseases only, and those have not proved favourable to its reputation. In some spasmodic affections of the respiratory organs it has gained a temporary celebrity only. In *hooping cough*, Dr. Butter[7] spoke favourably of it, as having the advantage over opium of not being liable to check expectoration. But though the violent and periodic fits of coughing are obviously of a spasmodic nature, and, therefore, apparently adapted for the use of hemlock, experience has fully proved that the disease is one which will run through a certain course. At the best, therefore, hemlock can prove a palliative only. In other forms of *spasmodic cough*, as well as in *spasmodic asthma*, hemlock deserves farther trial. In *tetanus*, conia or hemlock held out some hopes of doing good. Mr. Curling has kindly furnished me with the notes of a

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[1] *Essay on the Med. Nat. of Hemlock* [English transl.], 2d edit. 1762.

[2] See Bayle, *Bibl. Thérap.* iii. 618.

[3] *Med. Obs. and Inq.* iii. 400.

[4] See Bayle, *op. cit.*

[5] *United States Dispensatory.*

[6] Pearson, *Obs. on the Effects of Var. Art. of the Mat. Med. in Lues Venerea*, p. 62, 1800.

[7] *Treat. on the Kink-cough*, 1773.

case which occurred in the London Hospital. A tincture of hemlock seeds was exhibited on the eighth day of the disease, at first in doses of ♏xx. every hour, which were increased in the course of the three following days to f℥ij. every quarter of an hour, until the patient (a man aged 46) had taken, in all, two pints! but without any decided effect on the spasms or brain. Morphia and laudanum were afterwards used, but the man died. A small quantity of conia, obtained from three ounces of the same tincture used in this case, killed a cat in less than four minutes. In a case of *chorea*, treated by Mr. Curling, no relief was obtained by the use of the above-mentioned tincture, given to the extent of three ounces in twelve hours. The patient (a young man) ultimately died, exhausted from the long-continued and violent convulsions of nearly all the voluntary muscles.

Hemlock has been frequently employed as an *anodyne*, and often with apparent relief. As, however, conia does not appear to have the same paralysing influence over the sensitive, that it has over the motor nerves, some doubt has been raised on the real anodyne influence of hemlock. However, *in tender glandular enlargements, in painful ulcers, in scirrhus* and *cancer, in rheumatism*, and *in neuralgia*, hemlock has, at times, evidently mitigated pain; and its power of *allaying troublesome cough* is, in some instances, referable to its diminishing the preternatural sensibility of the bronchial membrane.

Anaphrodisiac properties have been ascribed to hemlock, and hence this remedy has been used in nymphomania and satyriasis.

Administration.—Hemlock is used in the form of *powder, tincture, extract, ointment*, and *poultice*.

Antidotes.—No chemical antidote is known for hemlock, though it is not improbable that an infusion of galls might be serviceable, as mentioned for *conia*. The first object, therefore, is to evacuate the poison from the stomach; this is to be effected by the same means as directed for poisoning by opium. If the poison be suspected to have passed into the bowels, a purgative is to be administered, unless diarrhœa have come on. The subsequent treatment will depend on the symptoms: blood-letting is frequently required to relieve the congested state of the cerebral vessels. Opium is generally prejudicial. Artificial respiration should not be omitted in extreme cases. As strychnia and nux vomica appear to produce a condition of the spinal chord opposite to that of conia, it is a question whether either of these agents might not be serviceable in the treatment of a case of poisoning by hemlock.

1. PULVIS CONII; *Powder of Hemlock.*—The powder, when properly prepared from the leaves, has the peculiar odour of the plant, and a fine green colour; but neither the odour nor the colour are absolutely indicative of activity. The test of the presence of conia is caustic potash, and, as the *Edinburgh College* properly observes, "the powder, triturated with aqua potassæ, exhales a powerful odour of conia." But the odour of the volatile oil of the plant being very analogous to that of conia, creates some difficulty with inexperienced persons. The vapour of conia, evolved from powdered hemlock by potash, fumes with hydrochloric acid; but the same occurs with ammonia, set free by the same agent. As the powder, however well prepared, quickly spoils by keeping, it is not a preparation which deserves confidence, and should never be used if it have been kept beyond the year. The dose of it is three or four grains twice or thrice daily, the quantity being gradually increased until some obvious effect (nausea, dryness of the throat, giddiness, headache, or disordered vision) in the system is produced. As different parcels of the powder possess very unequal powers, it is necessary, when changing the parcels, to recommence with small doses. I have elsewhere referred to the observation of Geiger, as to the small quantity, or even entire absence, of conia, in the dried leaves of hemlock.

2. **TINCTURA CONII**, L. E.; *Tincture of Hemlock.* (Hemlock leaves, dried, ℥v.; Proof Spirit, Oij. Macerate for seven days and strain, *L.* The formula of the *Edinburgh College* is as follows: "Fresh leaves of Conium, ℥xij.; Tincture of Cardamom, Oss.; Rectified Spirit, Oiss. Bruise the hemlock leaves, and express the juice strongly; bruise the residuum, pack it firmly in a percolator; transmit first the tincture of cardamom, and then the rectified spirit, allowing the spirituous liquors to mix with the expressed juice as they pass through; add gently water enough to the percolator for pushing through the spirit remaining in the residuum. Filter the liquor after agitation.")—The process of the Edinburgh College yields a much more energetic preparation than that of the London College, as it obviates the necessity of drying the leaves, and, therefore, much deserves the preference. If, however, the percolation were dispensed with, and the tincture prepared merely by adding spirit (not tincture of cardamom) to the expressed juice, the process would be greatly improved. If the leaves have been sufficiently pressed, the percolation is scarcely necessary, and, therefore, only adds to the labour and expense of the process. Any active matter lost by omitting percolation may be easily compensated by increasing the quantity of juice employed, the cost of which scarcely deserves notice. The employment of tincture of cardamom is objectionable, since it prevents the apothecary from forming a judgment of the colour, taste, and smell of, and the effect of potash on, this preparation: hence, in the London tincture it has been judiciously omitted. And lastly, if the percolation process be adopted, surely the directions of the Edinburgh College are too loose. The quantity of water which is to be employed "for pushing through the spirit" should be accurately defined, or it will be impossible to have preparations made at different times, and by different persons, of uniform strength. Good tincture of hemlock should evolve a strong odour of conia on the addition of potash. In 1837[1] I recommended the use of an *alcoholic tincture of the bruised fruit.* More recently, Dr. Osborne[2] has advised the same. *Tinctura conii*, L. is given in doses of fʒss. or fʒj. which are to be gradually increased until some effect is produced. *Tinctura conii*, E. must be employed more cautiously; though the quantity of hemlock leaves used by the Edinburgh College would, if dried, be scarcely half that employed by the London College (as 1000 parts of the fresh leaves yield only 185 parts when dried, according to

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[1] *Lond. Med. Gaz.* xix. 770.

[2] *Dub. Journ.* xvi. 469.

Henry and Guibourt).[1] The drying, however, as I have already noticed, greatly deteriorates the activity of the leaves.

SUCCUS CONII; *Preserved Juice of Hemlock.*—The method of preparing the preserved vegetable juices has been described. Mr. Bentley informs me that from 1 cwt. of hemlock leaves gathered in May he procured twelve imperial quarts of juice. The preserved juice of hemlock appears to me to be an excellent preparation.

3. **EXTRACTUM CONII**, L. E. D.; (*Succus spissatus Conii*, D.); *Extract of Hemlock.* (The *London College* directs this extract to be prepared in the same manner as Extract of Aconite; viz. fresh hemlock leaves, lb. j.; bruise in a stone mortar; then press out the juice, and evaporate it undefæcated to a proper consistence; and the *Dublin College* adopts a method of preparation the same as that for Extractum Belladonnæ. The following are the directions of the *Edinburgh College:* "Take of Conium any convenient quantity, beat it into a uniform pulp in a marble mortar, express the juice, and filter it. Let this juice be evaporated to the consistence of a very firm extract, either in a vacuum with the aid of heat, or spontaneously in shallow vessels exposed to a strong current of air freed of dust by gauze skreens. This extract is of good quality only when a very strong odour of conia is disengaged by degrees, on its being carefully triturated with aqua potassæ.") Most of the extract of the shops is inert, or nearly so. "We were one day," says Orfila[2], "in the shop of an apothecary, who had several times furnished us with the extract of hemlock, which we had administered to dogs in the dose of ten drachms, without producing any serious accident. We endeavoured to prove to him that the medicine was badly prepared; and, in order to convince him effectually, we swallowed, in the presence of several persons who happened to be in his shop, a drachm of this extract (seventy-two grains) dissolved in two drachms of water. We felt no effect from it, whilst twenty or thirty grains of the extract, well prepared, would have probably proved fatal to us. Let it be conceived now what advantage a person is likely to derive from such an extract, who takes one or two grains of it per day, or even thirty or forty, with the hope of getting rid of a scirrhous tumour, or of any other disease."

The extract of hemlock contains very little conia; this has been shown by Geiber and Christison, and has been verified by myself. From ℥iv. of extract, procured from one of the most respectable drug houses in town, I was unable to procure any sensible quantity of this alkali. "From what has come under my own observation," says Dr. Christison, "the extract of hemlock may become feeble, if not inert, in one of two ways,—either by the heat being continued after the concentration has been carried to a certain extent, or by long keeping. On the one hand, I have always observed, that from the point at which the extract attains the consistence of thin syrup, ammonia begins to be given off in abundance, together with a modified odour of conia; and, on the other hand, I have found extracts, which were unquestionably well prepared at first, entirely destitute of conia in a few years,—a remark which applies even to the superior exact prepared by Mr. Barry, of London, by evaporation *in vacuo*."

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[1] *Pharm. Raison.* i. 27.
[2] *Toxicol. Gén.* ii.

Mr. Brande[1] observes that "the most active extract is that which is procured by moderate pressure from the leaves only; when the stalks and stems are used and violent pressure employed, the extract is glutinous, dark-coloured, and viscid, and less active than in the former case, when it has a somewhat mealy consistency, and an olive-green colour. With every caution, however, on the part of the operator, the colour, odour, and efficacy of extract of hemlock will vary with the season, and with the situation and soil in which the herb has grown. The best method of preparing this and similar extracts consists in gradually heating the expressed juice to a temperature of about 212° [by which the vegetable albumen is coagulated, and retains, mechanically or chemically, a portion of the active principle], then to suffer it to cool, to strain it through moderately fine linen, and evaporate the strained liquor, and when it has nearly acquired a proper consistency, to add the matter which remained upon the strainer." One cwt. of hemlock yields from three to five lbs. of extract. If ammonia be evolved during the preparation of the extract, we may infer that a decomposition of the conia is going on. However carefully extract of hemlock may be prepared, I prefer for medicinal use the tincture made with the expressed juice as before stated. The dose of the extract should, at the commencement, be two or three grains, and gradually increased to five grains, or until some obvious effect is produced. [The goodness of the extract may be determined by the disengagement of a strong odour of conia when it is gradually triturated with Liquor Potassæ.—ED.]

4. **PILULA CONII COMPOSITÆ**, L.; *Compound Pills of Hemlock.* (Extract of Hemlock, ʒv.; Ipecacuanha, powdered, ʒj.; Treacle, as much as may be sufficient. Beat them together until incorporated.)—Antispasmodic, slightly narcotic, and expectorant. Used in spasmodic coughs, bronchitis, and the incipient stage of phthisis.—Dose, grs. v. to grs. x. twice or thrice daily. [In this preparation the London College has substituted treacle for a solution of gum.—ED.]

5. **UNGUENTUM CONII**, L.; *Hemlock Ointment.* (Fresh leaves of Hemlock, Prepared Hogs' Lard, of each, lb. j. Boil the leaves in the lard until they become crisp, then express through linen.)—It is employed as an anodyne application to foul, painful, and cancerous sores, to glandular and scirrhous swellings, and to painful piles. An extemporaneous substitute may be prepared with lard and the extract of hemlock.

6. **CATAPLASMA CONII**, L.; *Hemlock Poultice.* (Extract of Hemlock, ℥j.; Boiling Water, ℥x.; Powdered Linseed, ℥ivss. Add the linseed gradually to the water, constantly stirring to make a cataplasm. On this spread the extract, first softened with water.)—*A poultice of hemlock* is sometimes employed as a soothing anodyne application to cancerous, scrofulous, venereal, and other foul ulcers. It is sometimes prepared with the unstrained decoction and bruised meal; occasionally the bruised

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[1] *Dict. of Pharm.* 195.

leaves, or the dried herb with hot water, are used. *Hemlock fomentation* (*fotus conii*) is sometimes applied to painful swellings. It is prepared with the herb (fresh when it can be procured) and hot water.

258. RADIX SUMBUL.—SUMBUL ROOT.

SUMBUL[1], SAMBUL, MUSK-ROOT.

(Racine de Sambola ou Sambula, *Guibourt.*[2]—Moschus-wurzel of the Germans.)

This drug was introduced into Germany from Russia about the year 1840; more recently it has been brought under the notice of the medical profession in England.[3]

The botanical origin of Sumbul root is involved in obscurity: from a resemblance which it bears to Angelica, there is reason to think it is afforded by some nearly allied umbelliferous plant. It has been supposed a native of Persia; but we think there is greater reason to conclude that it is produced in some of the more remote regions of Central Asia. Dr. Granville states that it is brought into the Moscow drug market by way of Kiakta.

Two varieties of Sumbul have appeared in English commerce, viz.:—

1. **Russian Sumbul Root** (*Radix Sumbul Muscovitici*).—The Sumbul imported from Russia occurs in nearly circular pieces, formed by the transverse section of a large root: these pieces, which have a dirty, somewhat worn appearance, are from about $2\frac{1}{2}$ to 5 inches in diameter, and from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches in thickness at the edge, which, owing to unequal contraction in drying, is thicker than the central portion. On the outer edge they are covered with a dusky, brown, rough bark, frequently beset with short bristly fibres; the interior consists of a spongy, coarsely fibrous, dry, yellowish-white mass, of a somewhat farinaceous appearance. Some pieces, constituting the crown portion of the root, are covered with a papery bark. The root has a pure musky odour. Its taste is rather bitter, and very slightly acrid.

2. **Indian Sumbul Root** (*Chinese Sumbul Root?*); *Radix Sumbul Indici.*—A second variety of Sumbul root has been imported into England from Bombay. It is stated to be of closer texture, firmer, denser, and of a more reddish tint than the Russian sort. Some of the pieces are said to bear a slight resemblance to inferior rhubarb. In odour it is perhaps less powerful than the Russian.[4]

Sumbul root has also been brought to England *viâ* China. A sample in our possession, said to have been thus obtained, is in smoothly cut slices, having the cut surface of a dusky yellow or reddish-brown, surrounded with a paler zone. The external thin bark has been mostly peeled off, leaving visible a pale yellow inner bark. The pieces, which, from their regular edges, appear to have been cut from a *dried* root, are smaller than those of the Russian sumbul, denser, and sometimes of an almost unctuous aspect. The odour resembles that of the Russian sumbul, though rather weaker; the taste is bitter, and slightly suggestive of ammoniacum. Judging from the description of Indian sumbul root given in the *Pharmaceutical Journal*,[1] this variety is identical with it.

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[1] The Arabic word, *Sumbul*, signifying *an ear* or *spike*, has been applied to several odoriferous drugs, as, *e. g.* to the true spikenard, *Nardostachys Jatamansi*, De Cand., the *Sumbul Hindee* or *Indian Sumbul* of the East: see Sir William Jones *On the Spikenard of the Antients*, in the *Asiatic Researches*, ii. 405, iv. 111, Lond. 1799; also Richardson's *Persian, Arabic, and English Dictionary*, word *Sumbul*, i. 544, Lond. 1806.

[2] *Hist. des Drogues*, 4ème édit. iii. 195.

[3] See *The Sumbul, a New Asiatic Remedy*, by A. B. Granville, M.D. Lond. 1850.

[4] *Pharmaceutical Journal and Transactions* for Feb. 1852, xi. 358.

Sumbul root has been analysed by several German chemists,[2] the results of whose investigations show it to contain a volatile oil; two balsamic resins, one soluble in ether, the other in alcohol; wax, starch, &c. In addition to these a crystallisable acid has been obtained in minute quantity by Dr. Reinsch, and named by him *Sumbulic acid.*

Sumbul root may be administered in substance in doses of from grs. iij. to grs. viij.; in tincture, made by digesting for seven days ℥ij. of the root in ℥xvj. of proof spirit.[3] An ethereal tincture is likewise employed, as may be also, according to Dr. Granville, an aqueous infusion, decoction, or extract. The alcoholic tincture may be given in doses of from ♏xx. to ♏lx.

OTHER UMBELLIFERÆ, DIETETICAL OR POISONOUS.

All the more important medicinal Umbelliferæ have been noticed. It remains now to enumerate those plants in common use for dietetical purposes, or which are indigenous and poisonous.

Of the DIETETICAL UMBELLIFERÆ several have been already mentioned. To these may be added Parsley (*Petroselinum sativum*) and Chervil (*Anthriscus Cerefolium*), used as pot-herbs and garnishings; the Parsnip (*Pastinaca sativa*) and Skirret (*Sium Sisarum*), employed on account of their esculent roots; Celery (*Apium graveolens*), an acetarious plant, the blanched leaf-stalks of which are eaten raw as a salad; Common Samphire (*Crithmum maritimum*), which is pickled; Eryngo (*Eryngium campestre*), the root of which is preserved, and eaten as a candy (*Candied Eryngo; Radix Eryngii condita*); and Lovage (*Levisticum officinale*), used by distillers for preparing a liqueur termed *lovage.*

The POISONOUS INDIGENOUS UMBELLIFERÆ are acro-narcotics. When swallowed, they cause gastric irritation, giddiness, delirium, convulsions, and coma. The most important (after Conium maculatum, before mentioned), are Fool's Parsley (*Æthusa Cynapium*), which contains a peculiar alkaloid called *cynapina;* Hemlock Water-dropwort (*Œnanthe crocata*); Celery-leaved Water-dropwort (*Œnanthe apiifolia*); and Water Hemlock (*Cicuta virosa.*)

[Parsley seeds and their educt *Apiol* have lately been much recommended by Drs. Joret and Homolle as a substitute for quinine in the treatment of intermittent fever. They obtain the *apiol* by acting on the alcoholic extract of the seeds by sulphuric ether, then evaporating the ether and purifying the oil by litharge and animal charcoal.

Apiol is a yellow oily liquid, of a peculiar smell, and a disagreeable taste. Sp. gr. 1078. It is not volatile, does not boil at 528° F, but burns with a bright flame, leaving no residue. It is soluble in ether, alcohol, and chloroform, but not at all in water. It is coloured red by sulphuric acid. Parsley seeds likewise contain an essential oil, pectine tannic acid, and a peculiar fatty substance.

PHYSIOLOGICAL ACTION.—In small doses, apiol seems principally to act on the nervous system, causing a slight excitation; but in larger doses it causes headache, giddiness, &c., like quinine.

USE.—In intermittent fevers, apiol was administered by the authors in 116 cases, of which 66 were cured by it. The French commission, however, found only 42 per cent. temporarily cured, and in many of those the ague returned; and that its unpleasant flavour prevented its administration except in the form of capsules.

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[1] Vol. xi. p. 358.

[2] Quoted in *Journ. de Pharm.* xix. 278, 1851.

[3] *Pharmaceutical Journal and Transactions*, xi. 144.

It has likewise been used with good success in intermittent neuralgias and in the nocturnal sweats of phthisis. Dose for adults, 15 grains.[1]—ED.]

ORDER LX. CUCURBITACEÆ, *Jussieu.*—THE GOURD TRIBE.

CHARACTERS.—*Flowers* usually unisexual, sometimes hermaphrodite. *Calyx* 5-toothed, sometimes obsolete. *Corolla* 5-parted, scarcely distinguishable from the calyx, very cellular, with strongly-marked reticulated veins, sometimes fringed. *Stamens* 5, either distinct or cohering in 3 parcels; *anthers* 2-celled, very long and sinuous. *Ovary* inferior 1-celled, with three parietal placentæ; *style* short; *stigmas* very thick, velvety, or fringed. *Fruit* fleshy, more or less succulent [occasionally dry, opening by valves], crowned by the scar of the calyx, 1-celled [in some Momordicas 3- or 4-celled], with three parietal placentæ. *Seeds* flat, ovate, enveloped in an aril, which is either juicy or dry and membranous; *testa* coryaceous, often thick at the margin; *embryo* flat, with no *albumen*; *cotyledons* foliaceous, veined; *radicle* next the hilum.—*Roots* annual or perennial, fibrous or tuberous. *Stem* succulent, climbing by means of tendrils formed by abortive leaves (stipules, *St. Hil.*) Leaves palmated, or with palmated ribs, very succulent, covered with numerous asperities. *Flowers* white, red, or yellow (Lindley).

PROPERTIES.—Variable; suspicious. The roots and fruits of many species are drastic cathartics. The fruits of other species are employed as articles of food.

259. CITRULLUS (*Cucumis*, Linn.) COLOCYNTHIS, *Schrad.*—THE BITTER CUCUMBER, OR COLOCYNTH.

Sex. Syst. Monœcia Syngenesia.[2]

(Fructus Decorticatus, *L.*—Pulp of the Fruit, *E.*—Fructûs pulpa, *D.*)

HISTORY.—Colocynth is supposed to be the plant termed, in the Old Testament,[3] the *wild vine* (literally *the vine of the field*), whose fruit the Sacred historian calls *pakkoth*, a word which in our translation is rendered *wild gourd.* To understand the passage referred to, it is to be remembered that different kinds of gourd are commonly used in the East for shredding into pottages.[4] Colocynth was employed by the Greeks at a very early period. Hippocrates[1] employed κολοκυνθὶς ἄγρια (*cucurbita sylvestris*, or *wild gourd*) only in pessaries for bringing on menstruation. Dioscorides[2] gives a good description of colocynth. Pliny[3] calls it *colocynthis*.

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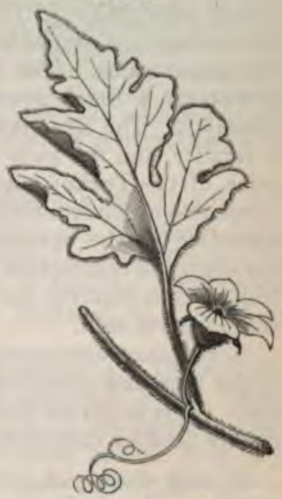
[1] *Annuaire de Thérapeutique*, 1855, p. 202.

[2] The followers of Linnæus are by no means agreed with their great master, or among themselves, as to the true order of Cucumis, and some other cucurbitaceous genera. The male flowers have, apparently, three stamina; but of these, two have an anomalous structure, and are regarded by some botanists as stamina with doubly-folded anthers; by others, as being composed each of two adherent stamina. Hence some have considered the flowers to be *triandrous*, others *pentandrous*,—the latter, taking into account the adhesion of the stamina, consider them to be *syngenesious*, *triadelphous* (*polyadelphous*), or *monadelphous*. So that while Linnæus adopted *Monœcia Syngenesia*, as the class and order, Turton placed Cucumis in *Monœcia Triandria*; Smith in *Monœcia Pentandria*, or *Mon. Polyadelphia* (see his *Introd. to Botany*, 4th ed., p. 363); Willdenow, Persoon, and Loudon, in *Monœcia Monadelphia*; while Sprengel, in conformity with his modification of Linnæus's sexual system, places it in *Monadelphia Monandria.*

[3] 2 *Kings*, iv. 39.

[4] *Picture Bible*, ii. 226.

FIG. 43.



Cucumis Colocynthus.

[BOTANY. **Gen. Char.** — *Corolla* persistent, quinquepartite, roundish. *Anthers* triadelphous and bilocular. *Style* trifid. *Stigmas* obcordate, convex. *Fruit* fleshy (peponida) many-seeded (Arnott).[4] — ED.]

Sp. Char. — *Stem* procumbent, somewhat hispid. *Leaves* cordate-ovate, many-lobed, white, with hairs beneath; the lobes obtuse; the petioles as long as the lamina. *Tendrils* short. *Flowers* axillary, solitary, stalked; *females* with the tube of the calyx globose, somewhat hispid, the limb campanulate, with narrow segments. *Petals* small. *Fruit* globose, smooth, yellow, when ripe, with a thin solid rind and a very bitter flesh (De Cand.)

Root annual, white, branched. *Stems* herbaceous, angular, branched. *Leaves* bright green on the upper side, paler, and clothed with whitish hairs underneath. *Tendril* filiform, branching, opposite each leaf. *Calyx* 5-toothed. *Corolla* yellow, with greenish veins. *Males: stamens* 3, short, free; two of which have doubly-bent anthers, or consist of two anthers; in which case the number of stamens is really five. *Females: ovarium* round, smooth, inferior; *style* short, cylindrical; *stigmas* 3; *filaments* without anthers. *Fruit* (*pepo*) about the size of an orange, with a thin but solid rind.

Hab. — Japan, the sandy lands of Coromandel, Cape of Good Hope, Syria, Nubia, Egypt, Turkey, and the islands of the Grecian Archipelago. Cultivated in Spain.

PREPARATION OF THE FRUIT.—The fruit is gathered in autumn, when ripe and yellow, and in most countries is peeled and dried, either by the sun or by stoves.

COMMERCE.—Colocynth is imported from Spain (Almeria, Gibraltar, Cadiz, and Malaga), Trieste, Smyrna, Alexandretta, and Mogadore. It comes over in cases, casks, boxes, &c. In 1839, duty (2d. per lb.) was paid on 10,417 lbs.

DESCRIPTION.—The fruit called *colocynth* or *coloquintida* (*colocynthis; poma colocynthidis*) is imported either *peeled* (generally), or sometimes *unpeeled*. Its *pulp* (*pulpa colocynthidis exsiccata*) is nearly white, inodorous, light, spongy, porous, tough, intensely and nauseously bitter. The seeds (*semina colocynthidis*) are smooth, either white or yellowish-white (*white colocynth seeds*), or brownish (*black colocynth seeds*), bitter, especially the dark-coloured ones, and inodorous. By digesting them in repeated portions of boiling water, and afterwards well washing them, the greater part of the bitterness may be extracted. Two kinds of colocynth, distinguished as *Turkey* and *Mogadore colocynth*, are known in commerce.

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[1] Pages 263 and 265, ed. Fœs.

[2] Lib. iv. cap. 178.

[3] *Hist. Nat.* xx. 8, ed. Valp.

[4] *Hooker's Journal of Botany*, iii. 271.

α. **Turkey Colocynth**: *Peeled Colocynth.*—[There are two qualities of peeled colocynth: 1. The TURKEY, which is imported from Smyrna, Alexandretta, Constantinople, and the Italian seaports; all known under the same name. The pepo of this quality is not only larger, but it contains a much greater proportion of pulp than the second variety, namely, 2. The SPANISH. The pepo of this variety of peeled colocynth is smaller, and the pulp is lean. It fetches only a little above half the price of the Turkey colocynth.—ED.] The usual size of each pepo is about two or three inches in diameter; the shape is more or less globular, according to the evenness with which the rind has been removed, and the degree of contraction in drying; the colour is white, or pale yellowish-white. One hundred parts by weight are said to consist of 28 parts pulp, and 72 parts seed.

β. **Mogadore Colocynth**: *Unpeeled Colocynth.*—The pepo of this kind is larger than the preceding, and is covered with a yellowish, smooth, firm rind. It is imported from Mogadore in small quantity only, and is principally used by druggists for show-bottles.

The seeds of colocynth are usually described as white, perfectly bland, and highly nutritious. Captain Lyon[1] states they constitute an important article of food in Northern Africa. "The seeds of Cucurbitaceæ," says De Candolle,[2] "do not participate in the qualities of the pulp which surrounds them; they are bland, demulcent, of an oily nature, and susceptible of easily taking the form of an emulsion." These statements do not apply to Colocynth seeds of commerce, which I never found devoid of bitterness; and Hillefeld[3] says a scruple of them purged a dog. Heise[4] found them poisonous.

COMPOSITION.—In 1817, Braconnot[5] analysed the watery extract. The pulp was analysed in 1818 by Meissner.[6] Vauquelin[7] examined the active principle.

Meissner's Analysis.	
Bitter Matter (*Colocynthin*)	14·4
Extractive	10·0
Bitter fixed oil	4·2
Resin insoluble in ether	13·2
Gum	9·5
Bassorin	3·0
Gummy extract (obtained from the ligneous fibre by potash)	17·0
Vegetable jelly	0·6
Phosphate of lime and magnesia	5·7
Ligneous fibre	19·2
Water	5·0
Colocynth Pulp	101·8

Braconnot's Analysis.	
Bitter matter (*Colocynthin*), with some resin	41·4
Resin	4·3
Vegetable jelly (*pectin*)	18·6
Azotic matter	21·4
Acetate of potash	5·7
Deliquescent salt of potash not soluble in alcohol	7·1
Watery Extract of Colocynth	98·5

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[1] Duncan, *Edinb. Dispens.*
[2] *Essai sur les Prop. Méd. des Plantes*, 191.
[3] Marx, *Lehre v. d. Giften*, ii. 27.
[4] *Ibid.* 34.
[5] *Journ. de Phys.* lxxxiv. 337.
[6] Pfaff's *Syst. d. Mat. Med.* vi. 365.
[7] *Journ. de Pharm.* x. 416.

COLOCYNTHIN: *Colocynthite; Bitter* or *Purgative Principle of Colocynth.*—By digesting the watery extract of colocynth in alcohol, and evaporating the tincture thus procured, we obtain a mass, composed, according to Vauquelin, of a bitter principle and acetate of potash. A little water readily dissolves the latter, leaving the bitter resinoid matter, to which the name of *Colocynthin* has been applied. It is a yellowish-brown, translucent, brittle substance, dissolving in water, but much more readily in alcohol. The aqueous solution is precipitated by the tincture of galls, and by some metallic solutions (protosulphate of iron, sulphate of copper, and nitrate of mercury). [This latter effect is owing, however, to the colocynthin not being pure; as Mr. Wm. Bastick has shown that when quite pure from foreign matters, it possesses neither basic nor acid properties. It appears also, from the experiments of the same gentleman, that colocynthin is oxidised by digestion with nitric acid, and a substance formed having weak acid properties, for which he proposes the name of colocynthic acid.[1]—ED.]

CHEMICAL CHARACTERISTICS.—The cold infusion is pale yellow, and very bitter; nitrate of mercury, sulphate of copper, and acetate of lead, cause in it gelatinous-flocculent precipitates (*pectates?*); sesquichloride of iron and tincture of nutgalls do not render it turbid. Powdered colocynth gives scarcely any evidence of the presence of starch, on mixing it with tincture of iodine and water.

PHYSIOLOGICAL EFFECTS. α. *On Animals generally.*—The animals on whom the action of colocynth has been examined are horses, dogs, sheep, and pigs. On dogs its operation appears to be analogous to that on man. Thus Viborg,[2] states that two drachms caused in a dog violent vomiting and purging; and Orfila[3] has shown that three drachms introduced into the stomach (the œsophagus being tied) are capable of causing death. It is remarkable, however, that its operation on horses is comparatively slight, at least according to the testimony of Viborg, Bourgelat, and Moiroud.[4] The last-mentioned writer says he has given four drachms to a horse without exciting the least disorder; and he adds that another cucurbitaceous plant (bryony) has likewise very little effect on the horse.

β. *On Man.*—Thunberg[5] tells us that, at the Cape of Good Hope, the colocynth fruit is said to be eaten when pickled, both by the natives and colonists, although it is very bitter. Mr. Dunsterville, surgeon, of Algoa Bay, formerly one of my pupils, tells me that the colocynth growing there does not possess the least bitterness. This may not be the medicinal plant.

Colocynth taken in *small* or *moderate doses* acts as a very safe and useful purgative. Its operation is not limited to the acceleration of the vermicular movements, but is extended to the secreting and exhaling vessels of the alimentary canal, whose functions it promotes. Moreover, it stimulates the other abdominal organs; and after the absorption of its bitter acrid principle, it not unfrequently proves diuretic. *In full doses,* it operates as a very active or drastic cathartic and hydragogue; but I have never seen any ill effects from its use. These remarks apply to the compound extract, the only preparation of colocynth of which I have personal experience. It would appear, partly from observation in the human subject, and also from the experiments of Orfila on dogs, that colocynth is one of those purgatives which exert a specific stimulant influence over the large intestines. *In excessive doses*, colocynth, both in powder and decoction, has on several occasions operated as a mortal poison, causing violent vomiting and purging, griping pain, and other symptoms of gastro-intestinal inflammation. A tea-spoonful and a half of the powder (about ʒiss.) has proved fatal.[1] In a case related by Orfila[2] there were, besides the preceding symptoms, dimness of sight and slight delirium. In M. Carron d'Annecy's case[3] the purging was followed by extreme tension and tenderness of belly, suppression of stools and urine, retraction of the testicles, and priapism. On a post-mortem examination there were found, besides the usual evidences of inflammation of the bowels, traces of inflammation of the liver, kidneys, and the bladder.

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[1] *Pharmaceutical Transactions*, x. 239.
[2] Wibmer, *Wirk. d. Arzneim. u. Gifte*, ii. 230.
[3] *Toxicol. Gén.*
[4] *Pharm. Vét.* 274.
[5] *Travels*, ii. 171.

Considered in relation to other cathartics, colocynth will be found to rank near gamboge, from which it is distinguished by at least two circumstances: first, its cathartic effect is not the mere result of its topical acrid operation, but, in part, of its specific influence over the bowels; secondly, its action on the large intestine is more manifest than that of gamboge. In the latter property, colocynth approximates to aloes; but while it greatly exceeds the latter in its cathartic and hydragogue effects, it is devoid of the tonic influence possessed by aloes, when used in small doses.

USES.—Besides being useful as an ordinary purgative, colocynth is adapted for acting as a stimulus to the abdominal and pelvic vessels and nerves in cases of torpor or inactivity, and on the principle of counter-irritation already explained for determining from other organs. The objections to its use are acute inflammatory affections of the alimentary canal, diseases of the large intestine, &c. The following are the principal cases in which it is employed:—

1. *In habitual constipation.*—As an ordinary purgative for keeping the bowels regular, the compound extract of colocynth is in common use both among the public and medical men. It operates mildly, certainly, and effectually. I am acquainted with individuals who have taken this substance for years without suffering any inconvenience therefrom. The simple extract is sometimes employed as a substitute, but is less advantageous.

2. *In alvine obstruction.*—In some cases of obstinate constipation, with sickness and other symptoms of an extremely irritable stomach, the compound extract of colocynth occasionally proves invaluable. Occupying but a small bulk, it is retained on the stomach, and succeeds in producing alvine evacuations, where the ordinary liquid purgatives fail, in consequence of being vomited up. Doubtful cases of intus-susception and hernia, even with stercoraceous vomiting, I have seen completely relieved by it. More than once have I known an operation averted by

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[1] Christison, *On Poisons*.
[2] *Toxicol. Gén.*
[3] *Ibid.*

its use, in those who, in addition to the above symptoms, had old herniæ, which led the surgeon to suspect strangulation. A slight degree of abdominal tenderness is not to be considered as absolutely prohibiting its use. Occasionally the extract is rubbed down with soap and water, and administered as an enema (*see Enema Colocynthidis*).

3. *In diseases of the brain.*—In apoplexy, or a tendency thereto, in paralysis, insanity, violent headache, &c. colocynth is sometimes employed with good effect, on the principle of revulsion or counter-irritation.

4. *In dropsy.*—In dropsical affections, colocynth has been used as a *hydragogue.* But in this country it is less frequently employed for this than for other purposes: various other hydragogues (especially elaterium and jalap) being usually preferred. It is sometimes employed as a *diuretic*, being given in the form of decoction. Hufeland regarded it as a most effectual diuretic in persons of a cold and sluggish habit of body.[1]

5. *In amenorrhœa and chlorosis.*—In some cases of obstructed menstruation, benefit is obtained by the use of drastic purgatives, like colocynth, which act on the rectum, and by contiguous sympathy, affect the uterus.

ADMINISTRATION.—The *powder*, which is rarely used, may be administered in doses of from two to eight or ten grains, intimately mixed with some mild powder (gum, or starch). The *decoction* (prepared by boiling ʒij. of colocynth in Oj. of water for six minutes, and, according to Hufeland, adding to the strained liquor, fʒij. of the spirit of sulphuric ether, and f℥j. of syrup of orange peel) is given in doses of f℥ss. three times a day. The *tincture* (prepared according to the Prussian Pharmacopœia, by digesting ℥j. of colocynth pulp and ʒj. of star anise, in lb. j. of rectified spirit) is given in doses of twenty drops. Colocynth has been employed iatraleptically by Dr. Chrestien.[2] The tincture of colocynth, or an ointment consisting of twenty grains of the powder mixed with hog's-lard, has been used by way of friction on the abdomen and inner side of the thighs, in disorders of the intellectual functions. Diuresis was a common effect.

ANTIDOTE. See *Elaterium.*

The following are the officinal preparations of colocynth:—

1. **EXTRACTUM COLOCYNTHIDIS**, L. E.; *Extract of Colocynth.* (Colocynth cut in pieces, rejecting the seeds, lbs. iij.; Distilled Water *Cong.* ss. Macerate the colocynth for thirty-six hours, frequently squeezing it with the hand. Press out the liquor and finally evaporate to a proper consistence, *L.* Colocynth, lb. j.; Water, *Cong.* ij. Boil gently for six hours, replacing the evaporated water occasionally. Strain the liquor while hot, and evaporate it in the vapour-bath to due consistency, *E.*—When the decoction is very concentrated, it readily gelatinises on cooling; hence it is necessary to strain it while hot. At Apothecaries' Hall, the produce of 100 lbs. of pulp is about 65 lbs of extract.[3] Extract of colocynth is an objectionable preparation, as it is very apt to become

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[1] Eberle, *Mat. Med.* 2d edit. i. 119.

[2] *Méth. Iatral.* p. 172.

[3] Barker and Montgomery, *Obs. on the Dub. Pharm.*

either mouldy or tough and hard by keeping. The dose of the London preparation is grs. v. to ℈j., and of the Edinburgh preparation grs. v. to grs. x. [Mr. Squire remarks that the formula of the London Pharmacopœia of 1836 was exactly what the Edinburgh now is, and proved a complete failure: the large quantity of slimy matter taken up by the water gave an inconvenient consistence to the extract and soon caused it to become mouldy. The present formula, in his opinion, orders barely enough water to wet the pulp thoroughly, and only about one-fourth of the fluid can be recovered by pressure. This on evaporation gives an extract about one-eighth part by weight of the colocynth pulp employed. He found that Proof Spirit answered better, and for this reason he prefers the formula for this extract given in the Prussian Pharmacopœia. Take of Colocynth, freed from the seed, and cut in coarse pieces, ℔j.; Rectified Spirit, ℔.vj. Digest at a lukewarm temperature for some days, frequently stirring, and press out strongly. Pour on the expressed pulp Proof Spirit, ℔.v. Digest again for twenty-four hours, with frequent shaking, and press. Clear the mixed liquids by decantation and straining, and evaporate in a vapour-bath at a temperature not exceeding 167° under constant stirring, to a pill-mass consistence. Take out the mass, dry it completely by a gentle heat, powder and preserve it carefully. Colocynth pulp, thus treated, yields one-third of its weight of extract.—ED.]

2. **PILULA COLOCYNTHIDIS COMPOSITA**, L. D. *Pilulæ Colocynthidis*[1], E. (formerly called *Compound Extract of Colocynth*). (Extract of Colocynth, ʒj.; Powdered Extract of Aloes, ʒvi.; Powdered Scammony, ʒij.; Powdered Cardamoms, ʒss.; Soft Soap, ʒjss. Mix the powders, and the remaining ingredients being added, beat all together so that a mass may be formed, *L.*; Pulp of Colocynth, in fine powder, ℥j.; Hepatic Aloes, in fine powder, ℥ij.; Scammony, in fine powder, ℥j.; Oil of Cloves, ʒj.; Castile Soap, ℥j; Treacle, by weight, ʒx. Reduce the soap to a fine powder, and mix it with the colocynth, aloes, and scammony, then rub all together with the oil of cloves and treacle, and beat them into a mass of a uniform consistence, *D.*[1]—The process of the *Edinburgh College* is as follows:—"Socotrine or East Indian Aloes, and Scammony, of each, eight parts; Colocynth, four parts; Sulphate of Potash, and Oil of Cloves, of each, one part; Rectified Spirit, a sufficiency. Pulverise the aloes, scammony, and sulphate of potash, together; mix with them the colocynth previously reduced to fine powder; add the oil of cloves; and, with the aid of a small quantity of rectified spirit, beat the whole into a proper pill mass, which is to be divided into five-grain pills." Compound pill of colocynth, made according to the London Pharmacopœia, is an exceedingly valuable preparation; but owing to carelessness, inattention, fraud, or ignorance, the preparation of the shops is very unequal in its powers. The aloes used in the process should be purified (by straining) as directed by the London College: the necessity of this will be obvious to any one who has ever seen a *cwt.* of aloes melted. Should the Cape variety be substituted for the finer kind of aloes, the

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[1] In the Dublin preparations, avoirdupois weight is directed to be used.

odour will detect the fraud. The scammony employed should be of the best quality. If the common (*i. e.* adulterated) kinds be used, the activity of the preparation is thereby deteriorated. If the compound pill, rolled into a ball and dropped into water, effervesce[1] on the addition of hydrochloric acid, we may infer that the scammony employed was adulterated with chalk. If the filtered decoction, slightly acidified, become blue or purplish on the addition of tincture of iodine, the presence of some starchy substance (as jalap or adulterated scammony) may be inferred. The mode of detecting gamboge will be described hereafter (see *Gamboge*). If colocynth seeds have been employed as a substance for the pulp, the tenacity of the extract, I am told, is greatly deteriorated. Some druggists substitute oil of cardamoms for the powder of the seeds, and by this means increase the odour of the preparation; but unless some inert powder be added to compensate for the powder of the seeds omitted, the strength of the preparation would be somewhat greater than that intended in the Pharmacopœia.

The compound pill of colocynth is a powerful, sure, yet safe cathartic. Its uses are the same as those of extract of colocynth before described. The dose of it is from five grains to a scruple. Calomel is frequently given in combination with it. The *Pilulæ catharticæ compositæ*, U. S. contain the compound pill of colocynth, extract of jalap, and calomel. Extract of hyoscyamus is frequently given in conjunction with the compound extract of colocynth. (See *Pilulæ Colocynthidis et Hyoscyami*, E.)

In the shops a cheap substitute for the compound pill of colocynth is often sold under the name of *pill cochiæ* (*pilulæ cocciæ*, or *pilulæ cochiæ minores* of Galen). The substitute sold under this name at Apothecaries' Hall, London, is the *Pilulæ colocynthidis*, Ph. Ed. without the sulphate of potash.

Colocynth is a constituent of *Morison's Pills*.[2]

3. PILULA COLOCYNTHIDIS ET HYOSCYAMI, E.; *Pills of Colocynth and Henbane.* (Colocynth-pill mass, *two parts;* Extract of Hyoscyamus, *one part.* Beat them well together, adding a few drops of rectified spirit, if necessary; and divide the mass into thirty-six pills.)—Extract of hyoscyamus diminishes the pain and griping frequently experienced from the use of colocynth, but does not injure its evacuant properties. Both Sir H. Halford and Dr. Paris[3] bear testimony to this.—The dose of this pill is grs. v. to grs. xv.

4. ENEMA COLOCYNTHIDIS, L.; *Colocynth Glyster.* (Extract of Colocynth, ʒss.; Soft Soap, ℥j.; Water, Oj. Mix and rub them together.)—A useful cathartic enema in obstinate constipation, whether arising from colic, or from other non-inflammatory conditions.

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[1] If the extract has been kept for some time it will effervesce, though it be made from pure scammony,—probably from the alkali of the soap becoming carbonated.

[2] See Frazer's Report of the *Trial of Joseph Webb*, at York Assizes, 1834, p. 53.

[3] *Pharmacologia*, 6th edit. i. 299.

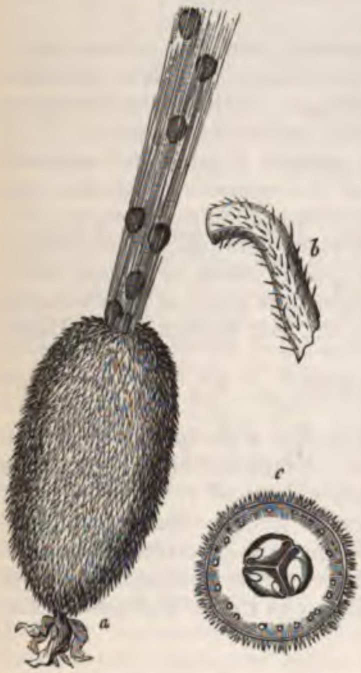
260. ECBALIUM OFFICINARUM, *L.*; ECBALIUM AGRESTE, (*D. Momordica Elaterium*).—WILD OR SPIRTING CUCUMBER.

Sex. Syst. Monœcia Syngenesia, *Linn.*[1]

(Fructus recens tantum non maturus, *L.*—Feculence of the juice of the fruit, *E.*—Fructus; Fæcula, Folia, *D.*)

HISTORY.—The term *ἐλατήριον* (from *ἐλαυνω*, *I impel* or *urge forward*) was employed by the Greeks to signify, not merely a medicine prepared from the *σίκυς ἄγριος*, or *wild cucumber* (*Momordica Elaterium*), but also any purgative substance.[2] Hippocrates[3] employed the root and leaves of the plant, as well as *ἐλατήριον*, in medicine. Dioscorides[4] minutely describes the method of preparing *ἐλατήριον* by drying the feculence of the expressed juice of the fruit, and making it into troches. Pliny[5] calls the plant *Cucumis sylvestris*, and gives a short account of the method of making elaterium. C. Bauhin[6] terms the plant *Cucumis asininus*, or *asses' cucumber*.

FIG. 44.



Momordica Elaterium.

a. Pepo expelling its seeds.
b. Stalk.
c. Transverse section of the pepo.

[BOTANY. — **Gen. Char.** — *Tendrils* lateral. *Stamens* monadelphous. *Anthers* connate. *Calyx* of males campanulate. *Fruit* expelling the seeds with elasticity; indehiscent. (Richard.)

Sp. Char.—Hispid, scabrous. *Stem* dwarf, without tendrils. *Leaves* cordate, somewhat lobed, crenate-toothed, very rugose, on long stalks. (Richard.) —ED.]

Root annual. *Stem* thick, round, trailing, and branching. *Leaves* obtuse, greyish, and strongly reticulated on the under side; petioles long and bristly. *Flowers* axillary: the males form racemes of 5 or 6 flowers. *Calyx* adherent, with 5 lanceolate acute teeth. *Corolla* campanulate, yellow, reticulated with green veins. *Males: stamina* 3, two of which bear doubly-folded anthers [or

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[1] See the note to Cucumis Colocynthis, p. 210.
[2] Fœsius, *Œconom. Hipp.*
[3] *Opera*, ed. Fœs. pp. 418, 547, and 877.
[4] Lib. iv. cap. 155.
[5] *Hist. Nat.* lib. xx. cap. 1 and 2, ed. Valp.
[6] *Pinax*, 314.

5, four of which cohere, so as to form two bundles of two anthers each]. *Females*: *filaments* 3, sterile; *ovarium* inferior, 1-celled (spuriously 3-celled; *style* simple; *stigmas* 3, bifid. *Pepo* small, elliptical, pedunculated, greyish-green, covered with soft prickles; when ripe separating from its stalk, and expelling, with considerable violence, its brown seeds, and a thin mucus through the aperture at the insertion of the stalk.

The phenomenon of the expulsion of the seeds of this plant has acquired, of late years, increased interest, from the circumstance of Dutrochet[1] having adduced it as one of the effects of *endosmosis*. It is well known that, when two fluids of unequal density are separated from each other by membrane (animal or vegetable), a double permeation of fluids takes place,—that is, each fluid passes through the membrane, and mixes with the other fluid: the current in one direction is called *endosmosis*, that in the opposite direction *exosmosis*.

Now to apply these facts to the phenomena of the Elaterium apple. In the centre of this fruit, and surrounding the seeds, is a very singular variety of organic matter, which appears like thick mucus. It is called by some botanists *placentary matter* (see fig. 44, *c*.). External to this, that is, in the tissue of the pericarp, there is another organic liquid, whose density is less than that of the placentary matter. These two fluids being separated from each other by membrane, are in a proper condition for the operation of endosmosis; consequently the central cell gradually becomes very much distended (at the expense of the liquid in the tissue of the pericarp), and ultimately gives way at the weakest point—namely, where the peduncle is articulated with the fruit, and the contents of the cells are expelled with great violence, from the sudden contraction of the distended tissues.

Seat of elaterium.—Some years since, Dr. Clutterbuck[2] ascertained that the active substance, elaterium, "is neither lodged in the roots, leaves, flowers, nor stalks, in any considerable quantity; nor is it to be found in the body of the fruit itself, or in the seeds contained within it; it was only in the juice around the seeds, therefore, that it could be looked for," and here it was found. The precise situation of it will be readily comprehended by inspecting a transverse section of the elaterium pepo (see fig. 44, *c*.) We observe that the external portion of the pericarp (namely, the epicarp) is furnished with rigid hairs; within the epicarp is a whitish sarcocarp, forming what Dr. Clutterbuck terms the body of the fruit. The centre of the fruit is divided into three cells, by projections of the three parietal placentæ to which the seeds are attached. Between these projections, and surrounding the seeds, is the *pulp*, *the placentary matter*, or the *juice around the seeds* (Clutterbuck). It is paler than the sarcocarp, and is composed of a very lax tissue, which, as the fruit maturates, takes on, says Aug. St.-Hilaire, a gelatinous consistency, becomes disorganised, and melts into water.

"The centre of the fruit of Momordica Elaterium," says Dutrochet,[3] "contains a very singular organic substance, and which has no resemblance to any other vegetable tissue. It seems to be a green very thick mucus. Viewed by the microscope, it appears to consist of an immense quantity of very small globules, agglomerated sometimes confusedly, sometimes so as to form irregular striæ. This substance is penetrated by a whitish liquid, by a sort of emulsion, which is so much the more dense as we observe it at an epoch nearer maturity. This aqueous liquid escapes immediately we open the green fruit. By the microscope we see some almost imperceptible globules which swim in this liquid. At the epoch of maturity this whitish liquid is much more abundant, and at the same time much denser; the globules, which it holds in suspension, have become much larger."

Hab.—South of Europe. Common on rubbish in the villages of Greece and the Archipelago. A few acres of it are annually cultivated at Mitcham.

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[1] *Nouv. Rech. sur l'End.* p. 66, 1828.
[2] *Lond. Med. Rep.* vol. xii.
[3] *Op. cit.* p. 69.

EXTRACTION OF ELATERIUM.—We are indebted to Dr. Clutterbuck for the present improved method of manufacturing elaterium.

a. DR. CLUTTERBUCK'S PROCESS. — "The cucumbers should be gathered when nearly as ripe as possible, and without violence that might endanger their bursting. They should then be wetted by the affusion of cold water, that less of the juice when they are cut may adhere to the external surface. In this state they should be cut through longitudinally, and the juice allowed to strain through a fine sieve, placed in a large earthenware vessel. The seeds and surrounding pulp should be scooped out upon the sieve, and washed with repeated affusions of cold water, by which they will be freed from all adhering juice. Something will be saved also by afterwards rinsing the split cucumbers themselves in cold water, from which a portion of elaterium may be collected.

"After standing a few hours a sediment is formed, from which the clear liquor is to be poured off; it is then to be thinly spread on fine linen, and exposed to the air to dry; a gentle warmth may be employed without injury, but the access of sunshine destroys the fine green colour which the substance otherwise acquires." From forty fruits, Dr. Clutterbuck obtained only six grains of elaterium. The elaterium thus procured is of the finest quality; but the product is very small.

β. PROCESS OF THE BRITISH PHARMACOPŒIAS. — The *London College* gives the following directions for its preparation:—Slice ripe wild cucumbers lengthwise, and strain the juice, very gently expressed, through a very fine hair-sieve; then set it by for some hours, until the thicker part has subsided. The thinner supernatant part being rejected, dry the thicker part with a gentle heat.—The processes of the *Edinburgh* and *Dublin Colleges* are essentially the same.

γ. PROCESS ACTUALLY FOLLOWED.—The following is the mode of preparation which I have seen practised at Apothecaries' Hall, London:—The fruits are cut longitudinally in halves by women, and are then placed in a hempen cloth and put into a common screw press. Apparently a tolerable pressure is applied, but for a few minutes only, being removed before all the juice has ceased running out. A greenish slightly turbid liquor runs out. When the fruits are taken out of the press they are but very slightly crushed, so that the pressure cannot have been great. The juice as it runs from the press falls into a hair-sieve, through which it flows into a cylindrical-lipped glass jar. Here it is allowed to remain for about two hours, during which time a greenish fecula is deposited. The supernatant liquor is then carefully poured off, and the thicker liquor at the bottom is placed on a paper filter supported by a cloth filter stretched on a wooden frame. A bitter, yellowish-brown (sherry-coloured) liquor runs through, and a green mass is left on the filter. The latter is then carefully dried by a stove, and constitutes the *finest elaterium*. The mother liquor, which was poured off from the deposit, is placed in shallow brown pans, and there lets fall a fresh deposit, which when separated and dried forms *a paler* elaterium.

After the elaterium has been deposited from the juice, a mucilaginous matter subsides, which greatly deteriorates the elaterium (if it has not been previously separated), and renders it when dry, dark, gummy, and much curled.

THEORY OF THE PROCESS.—Dr. Clutterbuck's experiments have shown that the finest elaterium is obtained without pressure from the fruits when nearly as ripe as possible. In practice, however, pressure must be employed; because the cucumbers must not be too ripe when gathered, or they are apt to burst during their journey to town, or by handling; and in this imperfectly ripe state the juice does not flow from them until pressure be employed. If the juice of one of the fruits be received on a plate of glass, it is at first nearly colourless and transparent. In a few minutes, however, by exposure to the air, it becomes slightly turbid (milky); and small white coagula are formed in it. By slow and spontaneous evaporation crystals of a rhomboidal figure are perceptible on the glass when examined by a magnifier. These crystals are *Elaterin*. They are probably formed by the influence of the air on the juice. Elaterium of commerce consists essentially of this elaterin contaminated with the green colouring matter, cellular tissue, and starch, expressed from the fruit, and mixed with the residue obtained by drying the bitter liquor above referred to, with which the tissues and elaterin were moistened.

DESCRIPTION. — The Elaterium (*Elaterium; Extractum Elaterii*, L. E. D.) of commerce is a very variable article. Two kinds are distinguished, the *English* and the *Maltese*.

1. **English Elaterium** (*Elaterium anglicum*) is manufactured at Apothecaries' Hall, at Mitcham, and perhaps at other places. The *finest* (*Elaterium album*, Auct.) occurs in light, friable, thin, very slightly curled flakes, or flat cakes, or fragments, which frequently bear the impression of the paper or muslin on which the elaterium was dried. Its colour is pale, greyish-green, which by exposure becomes yellowish. Its taste is acrid and bitterish; it has a faint animal odour (not very dissimilar to that of ergot of rye), but combined with a fragrancy which reminds me of senna or tea. By keeping nine or ten years, a sample of good elaterium in my museum has assumed a sparkling appearance, as if it contained very minute crystals.

Inferior kinds (*Elaterium nigrum*, Auct.) are sometimes hard, break with difficulty, or with a resinous fracture, are much curled, gummy, and dark-coloured (brown or olive-green). They are probably prepared from the juice, after the finest elaterium has been separated. In my museum, I have several varieties of this inferior kind, which were collected by Dr. Clutterbuck. One is in the form of a brownish powder. Dr. Clutterbuck states, that of the best specimens of elaterium from Apothecaries' Hall, spirit dissolves more than half; while of inferior sorts, a fourth part only is dissolved. Mr. Barry[1] says that the solubility of elaterium, manufactured by Dr. Clutterbuck's process, is as follows: —

Ten grains of Elaterium, manufactured according to Dr. Clutterbuck's process		*Dissolved in spirit, of specific gravity, 0·809.*
By Messrs. Allen and Co.	1st sample	5·5 grains.
	2d sample	6·2 "
	3d sample	6·4 "
At Apothecaries' Hall		6 "

2. **Maltese Elaterium** (*Elaterium melitense*). — This is imported from Malta. It is in much larger flakes than the best English elaterium, and frequently has some adherent paper on which it has been dried; its colour is much paler, sometimes with hardly a trace of green. Some specimens are more friable and softer, and occasionally are rather chalky to the touch. My specimens are mixtures of chalk and starch; hence they effervesce with acids, and become blue with iodine. I am assured that Maltese elaterium is mixed, in this country, with buckthorn juice, to deepen its colour, and promote its purgative operation.

COMPOSITION. — Braconnot[2] analysed the expressed, boiled, filtered, and evaporated juice of the plant. Soon after Dr. Clutterbuck's experiments on elaterium, Dr. Paris[1] analysed this substance. In 1831, Mr. Hennell[2] published an analysis of it. In 1835, Landerer[3] examined the juice of the fruit growing in Nauplia (Napoli). Futhermore, the active principle of elaterium was examined in 1831 by Dr. Morries[4], and afterwards by Marquart.[5]

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[1] Paris, *Pharmacol.*

[2] *Journ. Phys.* lxxxiv. 292.

Dr. Paris's Analysis.	
Elatin Bitter matter	1·2
Extractive	2·6
Fecula	2·8
Gluten	0·5
Woody matter	2·5
Water	0·4
Elaterium	10·0

Mr. Hennell's Analysis.	
Crystallisable substance (*Elaterin*)	44
Green resin	17
Starch	6
Woody fibre	27
Saline matters	7
Elaterium	101

1. ELATERIN (*Elaterine; Momordicine*). — Dr. Clutterbuck showed, in 1819, that the active principle of elaterium was insoluble in water, but soluble in alcohol; for he found a watery infusion of eight grains had no effect, whereas the alcoholic extract in the dose of one-sixteenth of a grain produced considerable purging, and often vomiting; and when the dose was increased to a quarter of a grain the effect was more considerable, and often took place in a very few minutes. The action of these liquids on elaterium led Dr. Clutterbuck to believe that the active principle was of a resinous nature. But the alcoholic tincture of elaterium contains three principles: elaterin, the green resin, and a bitter matter. By treating this alcoholic extract with boiling distilled water, the bitter matter is dissolved: the residue (elaterin and green resin) was termed by Dr. Paris *elatin*. Dr. Morries, in 1831, separated the green resin and isolated elaterin; though Mr. Hennell seems to have discovered it about the same time. Dr. Morries obtained it by evaporating the alcoholic tincture of elaterium to the consistence of thin oil, and then throwing it into boiling distilled water; a white crystalline precipitate was formed, which increased as the liquor cooled. This precipitate was afterwards purified by a second solution in alcohol and subsequent precipitation by water. Mr. Hennell's process was different. He separated the resin from the crystalline matter of the alcoholic extract of elaterium by ether, which took up the resin and left the elaterium; the latter was then purified by solution in hot alcohol and subsequent crystallisation. Marquart's process is less likely to yield pure elaterium, since he procured it from an extract prepared by evaporating the expressed juice. Another method (founded I presume on the directions of the Edinburgh College) for the determination of the goodness of elaterium, is to treat the alcoholic extract of elaterium with a solution of potash, which takes up the bitter matter as well as the resin, and leaves the elaterin. The quantity of elaterin in elaterium is thus stated by different authorities: —

100 *parts of Elaterium.*	*Quantity of Elaterin.*
Prepared according to the London College (*Hennell*)	44
Best British Elaterium (*Morries*)	26
Worst ditto (*Morries*)	15
French Elaterium (*Morries*)	5 or 6
Elaterium (*Edinburgh Pharmacopœia*)	14·3 to 25
Best specimens (*Balmer*[6])	33
Fine sample, prepared at Apothecaries' Hall in 1839, and dried by steam heat (*Pereira*)	26

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[1] *Pharmacologia.*

[2] *Journal of the Royal Institution*, i. 532.

[3] *Pharm. Central-Blatt für* 1835, 154.

[4] *Ed. Med. and Surg. Journ.* xxxv. 339

[5] *Pharm. Central-Blatt für* 1833, S. 850.

[6] *Lond. Med. Gaz.* xxv. 909.

These discrepancies must arise principally from the different degrees of goodness of samples examined; but partly also from different modes of proceeding. I found that 30 grs. of fine elaterium, prepared at Apothecaries' Hall in 1839, lost by drying on a steam bath 1·5 grs. Boiled in repeated portions of rectified spirit, the dried mass lost 18 grs. The concentrated green tincture poured into dilute liquor potassæ (see process of the *Edinburgh Pharmacopœia*, p. 220) deposited crystals which, dried by steam heat, weighed 7·5 grs.

Elaterin possesses the following qualities: it is crystalline, and has a silky appearance; the crystals, viewed by a magnifying glass, are observed to be rounded prisms with striated sides; it is very bitter, but odourless; is neither acid nor alkaline, and is insoluble in water, but soluble in hot alcohol. Mr. Hennell says it is only very slightly soluble in ether; whereas Dr. Morries states it to be readily soluble in both ether and fixed oil. It is fusible, according to Mr. Hennell, at 350° F., or at 392° Phillips. Mr. Hennell states that it is composed of *Carbon* 36·9, *Hydrogen* 23·9, and *Oxygen* 39·2, which nearly corresponds to the formula $C^6H^{12}O^5$.[1] Dr. Morries says, that at a high temperature it is dissipated in a thick, white, pungent vapour, having an ammoniacal odour: if so, nitrogen must be a constituent. But neither by the odour, nor by turmeric, can I detect ammonia in this vapour. The late Dr. Duncan, of Edinburgh, ascertained that in doses of one-twelfth or one-sixteenth of a grain it had all the effects of a dose of elaterium. "A tenth of a grain," says Dr. Christison, "as I have myself witnessed, will sometimes cause purging in man; and a fifth of a grain, in two doses, administered at an interval of twenty-four hours to a rabbit, killed it in seventeen hours after the second dose." Dr. Golding Bird thinks one-sixteenth of a grain a fair dose to commence with: he repeats it every two hours until some effect is produced. It may be taken dissolved in spirit, and by this diffused through an aqueous vehicle.

2. GREEN RESIN (*Chlorophylle?*).—Is insoluble in water, but dissolves in alcohol, ether, and caustic potash. It does not redden litmus, though from its ready solubility in caustic potash its acid nature might be suspected. Some of it, prepared by Mr. Hennell, was tried at St. Bartholomew's Hospital, and found to act powerfully as a purgative in doses of less than a third of a grain. Perhaps this might have arisen from the presence of elaterin; for twenty-one grains of the resin yielded four grains of elaterin.

3. BITTER MATTER.—This is soluble both in water and alcohol. Its taste is intensely bitter: its colour is brownish yellow.

CHARACTERISTICS.—Good elaterium is friable, has a pale greenish-grey colour, and an animal odour. Digested in rectified spirit it yields a fine green tincture. Thrown into water it floats. It does not effervesce in diluted hydrochloric acid: the acid liquor being digested on elaterium, and subsequently rendered nearly neutral by ammonia, gives scarcely any cloudiness on the addition of oxalate of ammonia. Touched with tincture of iodine, it gives no evidence of the presence of starch; though if it be boiled in water, the decoction, when cold, gives traces of starch, by the blue colour developed on the addition of iodine. If the ash formed by the burning of elaterium in the air be ignited in the outer cone of the flame of a candle, the presence of potash is indicated by the bluish or violet tinge.

Maltese elaterium has no odour, and scarcely any green tinge. Examined by the microscope, it is found to contain globules of wheaten starch. It sinks in water, effervesces with diluted hydrochloric acid, yielding a solution which, when nearly neutralised by ammonia, gives a copious precipitate (*oxalate of lime*) on the addition of oxalate of ammonia. Tincture of iodine stains it bluish or greenish black (*iodide of starch*). If the cinder obtained by burning Maltese elaterium in the air be ignited in the outer cone of the flame of the candle, it communicates an orange tint to the flame (lime?). The adulteration of elaterium by starch was known to Dioscorides. The *Edinburgh College*, (1841), gives the following characteristics of good elaterium:—

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[1] [According to Zwerger, its composition is $C^{20}H^{14}O^5$.—ED.]

> "Colour pale-grey: when exhausted by rectified spirit, the solution, concentrated, and poured into hot diluted aqua potassæ, deposits, on cooling, minute silky, colourless crystals, weighing from a seventh to a fourth of the elaterium."

In the Edinburgh Pharmacopœia for 1839, it was stated that elaterium should yield "at least a seventh" of elaterin; and in the first edition of the "*Elements*," I observed that "these characteristics are not sufficiently accurate. Good elaterium is pale *greenish*-grey: and when treated as the College directs, should yield 26 per cent. of crystals (*i. e.* elaterin)." It will be seen that the College has somewhat modified its original statement.

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—Macaire found a branch of the Momordica Elaterium was speedily destroyed by immersing it in a solution of the extract of this plant.[1]

β. On Animals.—Viborg[2] gave a pound of the fruit of Momordica Elaterium to a horse without any effect. Two and a half pounds of the whole plant (roots, leaves, and stem) also appeared inert. The only experiments made with the extract of elaterium that I am acquainted with, are those of Orfila[3] on dogs. They are three in number, and prove that this substance is a powerful local irritant, producing death even when it has been applied to the cellular tissue of the thigh, in consequence, as he supposes, of the nervous system being sympathetically affected. Moreover, he concludes, from his observations, that elaterium exerts a special action on the rectum.

γ. On Man.—The acridity of elaterium in its local operation is well shown by various facts. Pliny truly observes that the juice of the elaterium apple is dangerous when applied to the eye; and Dr. Clutterbuck mentions that some of it "getting accidentally into the eye in one instance, it occasioned severe pain and inflammation, with an erysipelatous swelling of the eyelids, that continued till the following day." We have a further proof of its irritant properties in the inflammation and ulceration of the fingers of those employed in its preparation. When swallowed, it irritates the gastro-intestinal membrane, and occasions vomiting and violent purging; hence it is called a *drastic purgative.* Fine elaterium, in the dose of 1-8th of a grain, seldom fails to purge violently, and sometimes to vomit. This was long since noticed by Dr. Clutterbuck; and I can verify his statement from repeated observations. Even 1-16th of a grain will generally excite considerable purging. The elaterium of the shops, however, is rarely so active as this; and I have known two grains given with no more effect than the pure elaterium would excite in the dose of 1-8th of a grain. Elaterium powerfully excites the secreting and exhaling vessels of the alimentary canal, and thereby occasions very watery stools: hence the term *hydragogue* applied to it. In some dropsical cases I have known a single dose discharge several pints of fluid by the bowels. The gripings and the increased number of evacuations prove that the irritation is not confined to the mucous coat, but is extended to the muscular coat. Under the influence of a full dose, the pulse is excited, the tongue becomes dry, and sometimes furred, and great thirst is produced. Occasionally the skin becomes damp under the operation of elaterium.

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[1] *Mém. de la Soc. de Phys. de Genève*, iv.

[2] Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 296.

[3] *Tox. Gén.*

Elaterium has been supposed to exert a specific influence over the uterus. Thus Dioscorides and even later writers state that it provokes the menses, and is apt to produce the death of the fœtus in utero. Its uterine influence, however, is probably not greater, in proportion to its cathartic property, than that of other violent drastics, which act powerfully on the large intestines.

Does elaterium become absorbed? We have no stronger evidence to offer in favour of the affirmative of this question than that mentioned by Hippocrates[1], that the milk of women and goats who have eaten elaterium, or the wild cucumber, possesses purgative properties. Furthermore, the accident which occurred to Dr. Robert Dickson, Lecturer on Botany at St. George's Hospital, seems to prove that absorption must have taken place by the skin.[2] Dr. Dickson carried a specimen of the plant in his hat to his lodgings, in Paris, from the Jardin-du-Roi. In half an hour he experienced violent headache, which was followed by colicky pain, violent purging, vomiting, and fever.

Considered with respect to other cathartics, we find it pre-eminently distinguished by the violence of its purgative effect. Croton oil alone approximates to it. Its hydragogue operation exceeds that of most, if not all other, ordinarily used drastics.

USES.—The principal use of elaterium is to excite watery evacuations *in dropsy*, by which a twofold effect is to be hoped for: viz. *first*, absorption of the effused fluid; *secondly*, the stoppage of any further effusion in consequence of the metastasis of vital action from the seat of the dropsy to the intestinal membrane. In dropsies dependent on, or accompanied with, disease of the kidney, the evacuation of water from the bowels is much to be preferred to the employment of stimulating diuretics, which may add to the severity of the renal malady. Of the violent hydragogue purgatives, elaterium I believe to be the most useful in dropsy. It evacuates more watery fluid than the others; while, if it be good, its operation may be relied on. It is objectionable where there is great debility, and where any inflammatory or other disease of the bowels exists. I have seen the fatal termination of dropsy apparently accelerated by the use of elaterium. A dropsical patient, much debilitated, took, by order of his physician, a dose of elaterium, which caused excessive alvine evacuations, great exhaustion, sinking of the pulse, syncope, and death. Where no contra-indication to the use of elaterium exists, one or two doses of it should be given every other day, for a week or ten days. If continued longer than this, it might perhaps bring on an inflammatory condition of the bowels. Dr. Darwall[3] mentions a case in which hypercatharsis and maniacal delirium were produced by the prolonged use of elaterium; the delirium, however, went off in a few hours. Some tonic (usually gentian) is commonly conjoined with elaterium. Thus a pill composed of elaterium and extract of gentian is frequently employed; or we may exhibit infusion of gentian on alternate days with the elaterium. Where there is a febrile condition of system, and also where there is an irritable or inflammatory condition of the alimentary canal, elaterium is inadmissible. It is best adapted for cold phlegmatic constitutions. Sydenham[1] recommended elaterium in dropsy: afterwards Lister[2], Heberden[3], Ferriar[4], Clutterbuck[5], and other experienced practitioners, bore testimony to its exceeding great efficacy. But judging by the doses recommended, all of them, except the last-mentioned writer, seem to have been unaware of the great activity of the medicine when pure.

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[1] Επιδημιων, lib. vi. sect. 5.

[2] *Journ. de Chim. Méd.* iv. 61.

[3] *Cyclop. Pract. Med.* art. *Anasarca*, vol. i. p. 79.

2. *In cerebral affections*, such as apoplexy, or a tendency to it (manifested by sleepiness, stupor, or giddiness), mania, &c., elaterium, as a drastic purgative, sometimes proves serviceable on the principle of counter-irritation or revulsion.

3. *In obstinate constipation* from sluggishness of the intestinal tube, elaterium is occasionally useful. But care must be taken to ascertain that the constipation does not depend on any mechanical impediment (as hernia, or intus-susception,) to the passage of the fæces.

4. *In gout.*—A combination of elaterium and opium has been found serviceable in gout.[6]

ADMINISTRATION.—The dose of good elaterium is from one-sixteenth to one half of a grain. I hear and read of practitioners giving this substance to the extent of one, two, or even three grains; but this can only be from the bad quality of the drug. I have repeatedly employed, and seen others exhibit elaterium, and have always observed that a quarter of a grain of good elaterium acted very powerfully, sometimes bringing away several pints of fluid; and half a grain usually occasioning vomiting, as well as violent purging. I confess I should not venture to exhibit a grain of the same preparation. It is usually given in the form of pills. The basis of the pills may be extract of gentian.

As elaterin (the active principle of elaterium) is soluble in rectified spirit, a *tincture of elaterium* (*tinctura elaterii*) may be employed. It contains, besides elaterin, a bitter principle and green resin. *Elaterin* has been given either in powder (mixed with sixty-four times its weight of bitartrate of potash), or in solution in rectified spirit (*solutio elaterinæ*) by Dr. Golding Bird[7] in doses of one-sixteenth to one-eighth of a grain.

ANTIDOTES.—In the event of a case of poisoning by elaterium, the remedies would be demulcent drinks and clysters, opium, the warm bath, and fomentations to the abdomen; stimulants (such as ammonia and brandy) if the circulation fail; bloodletting to subdue the inflammatory symptoms, should the state of the general system not contra-indicate it.

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[1] *Works*, by Dr. Pechey, 4th edit. p. 393, 1705.
[2] *De hydrope.*
[3] *Comment.* art. *Dropsy.*
[4] *Med. Hist. et Reflex.* vol. iv.
[5] *Lectures* in *Lancet* for May 6, 1826, p. 170.
[6] Sutton, *Tracts on Gout*, p. 201.
[7] *Lond. Med. Gaz.* xxv. 908.

OTHER DIETETICAL, MEDICINAL, OR POISONOUS CUCURBITACEÆ.

The fruits of several cucurbitaceous plants are employed as articles of food. The Cucumber (*Cucumis sativus*), the Melon (*Cucumis Melo*), the Water Melon (*Cucumis Citrullus*), the Vegetable Marrow (*Cucurbita ovifera*), the Pumpkin or Pumpion) (*Cucurbita Pepo*), and the Melon-Pumpkin or Squash (*Cucurbita Melopepo*), are those in most frequent use. They contain a watery, sweet or acidulous cooling pulp, which is slightly nutritious when taken raw, and in some habits proves laxative.

The fresh root of *Bryonia dioica* is sold by herbalists under the name of *White Bryony* and *mandrake root*. Fashioned into a rude representation of the human figure, I have seen it exhibited at an herb-shop as a sign. Bryony root contains a peculiar bitter matter called *bryonin*. The root operates as a violent emetic and purgative. I have seen one case of poisoning by it. The symptoms were those of cholera. As the accident occurred at the time when this disease was raging here, the practitioner who was called in concluded it was a case of cholera, and mistook a piece of bryony root, shown him as being part of what the patient had eaten, for a piece of turnip. The patient (a woman) recovered. Bryony root is employed as a topical application to bruised parts.

ORDER LXI. MYRTACEÆ, *R. Brown.*—THE MYRTLE TRIBE.

CHARACTERS.—*Sepals* 4-6, generally 5, concreted into a tube, which is adnate to the ovary, sometimes distinct at the apex, and as far as the margin of the ovary, at other times concrete at the apex, and as far as the throat. *Petals* inserted on the calyx, as many as the sepals with which they alternate, and quincuncial in æstivation, very rarely absent. *Stamens* inserted with the petals, often in many rows, double, or generally many times the number of the petals: *filaments* either free or variously all connected or polyadelphous, before flowering somewhat incurved; *anthers* ovate, bilocular, small, dehiscing by a double chink. *Carpella* 4-6, generally 5, by abortion often fewer, concrete into a many-celled ovary, which is adnate to the calyx. *Style*, composed of many partial styles concreted, and, therefore, called single, with a simple stigma. *Fruit* various, many-celled, many-seeded. *Seeds* various; *embryo* exalbuminous (De Cand.).—*Trees* or *shrubs*. *Leaves* generally opposite, rarely alternate, exstipulate, quite entire, dotted with pellucid glands, and usually with a vein running parallel with their margin. *Inflorescence* variable; usually axillary. *Flowers* red, white, occasionally yellow, never blue.

PROPERTIES.—Aromatic volatile oil and astringent matter (especially the former) are the principles to which the medicinal properties of Myrtaceæ are referable. The pellucid dotting of the leaves and other parts indicates the volatile oil.

261. MELALEUCA MINOR, *Smith, L. E.*; MELALEUCA CAJUPUTI, *D.*—THE LESSER MELALEUCA.

Melaleuca Cajuputi, *Maton*, *Roxburgh*.
Sex. Syst. Polyadelphia Icosandria.
(Oleum è foliis destillatum, *L.*—Volatile oil of the leaves, *E.*)

HISTORY.—This tree was described by Rumphius[1] under the names of *Arbor alba minor*, *Cajuputi*, *Daun kitsjil*, and *Caju-kilan*. It has got its name from its colour *kāyu-puti*, which signifies *white wood*, and hence its appellation, as given to it by Rumphius, *arbor alba*.[1]

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[1] *Herb. Amboin.* lib. ii. p. 76.

BOTANY. **Gen. Char.**—Tube of the *calyx* almost hemispherical; limb 5-partite. *Petals* 5. Bundles of *stamens* 5, elongated, alternate with the petals; *anthers* incumbent. *Style* filiform; *stigma* obtuse. *Capsule* connate with, and enclosed in, the thickened tube of the calyx, which is adnate at its base to the branch; 3-celled, many-seeded. *Seeds* angular (De Cand.)—*Trees* or *shrubs*. *Leaves* alternate or opposite, quite entire, equal at the base. *Flowers* sessile, or somewhat adnate, spiked or capitate, white, yellowish, or purplish.

Sp. Char.—*Leaves* alternate, elliptical-lanceolate, somewhat acute, slightly falcate, 3-5-nerved. *Flowers* spiked, rather distant. *Rachis*, *calyx*, and *branchlets*, villose (De Cand.)

Trunk tolerably erect, but crooked: *bark* thick, spongy, whitish ash-coloured, the exterior lamina peeling off in thin flakes. *Branches* scattered, often drooping. *Leaves* short-stalked, while young silky, when full grown smooth, deep green, from 3 to 5 inches long, and from half to three-quarters of an inch broad, very aromatic when bruised. *Spikes* terminal. *Bracts* solitary, lanceolate. *Calyx* urceolate. *Corolla* white. *Filaments* from 30 to 40, united into five portions at the base: *anthers* with a yellow gland at the apex. *Style* rather longer than the stamina: *stigma* obscurely 3-lobed; *ovary* ovate, united to the calyx. *Capsule* 3-valved.[2]

Hab.—Moluccas.

EXTRACTION OF THE OIL.—Rumphius[3] states that the leaves are gathered on a warm day, and placed in a sack, where they become hot and damp. They are then macerated in water, and left to ferment for a night, and afterwards submitted to distillation. Two sackfuls of the leaves yield scarcely three drachms of oil, which is limpid, pellucid, and volatile. Lesson[4] has described the method of obtaining the oil at Bourou, one of the Molucca islands. The leaves, he says, are gathered in the latter end of September, and put into the cucurbit of a copper alembic, surmounted by a neck, terminated by a capital without a refrigeratory, and a sufficient quantity of water is then added. By distillation, this liquid is made to traverse a worm immersed in a hogshead filled with water, and is collected in a vessel; the oil which floats is very light, and of an herbaceous green colour, which is owing to chlorophylle, or perhaps a somewhat different resinous principle. By rectification it becomes colourless.

DESCRIPTION.—*Cajuput* or *Kyapootie oil* (*oleum cajuputi*) is usually imported in green glass bottles (in appearance similar to long-necked beer bottles). Its colour is green, the tint being that of a strong solution of chloride of copper. It is transparent, limpid, of a strong penetrating smell, resembling the combined odour of camphor, rosemary, and cardamom, and of an aromatic camphoraceous taste, succeeded by a sensation of coolness like that caused by oil of peppermint. In the mass the odour is disagreeable, but in small quantity, as when rubbed on the hand, is much more fragrant. An apparently pure sample, which has been several years in my museum, has a sp. gr. of 0·925. Dr. Thomson[1] says, the sp. gr. varies from 0·914 to 0·9274: while Mr. Brande[2] states it to be 0·980. Oil of cajuput is soluble in alcohol. Its boiling point is 343°. When carefully distilled with water, the first portion of oil which passes over is very light, and quite colourless: but towards the end of the process a heavier and greenish oil distils over.

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[1] *Mat. Indica*, i. 261; and Crawford, *Hist. Ind. Archip.* vol. i. p. 513.

[2] Condensed from Roxburgh, *Fl. Ind.* iii. 395; and *Trans. Med.-Bot. Soc.* April 11, 1828.

[3] *Herb. Amboin.*

[4] *Journ. de Chim. Méd.* iii. 237.

COMPOSITION.—According to Blanchet[3] the composition of oil of cajuput ($C^{10}H^{9}O$) is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	10	60	77·92
Hydrogen	9	9	11·69
Oxygen	1	8	10·39
Cajuputi Oil	1	77	100·00

ADULTERATION.—M. Guibourt[4] detected in several samples of oil of cajuputi, oxide of copper in solution. It is, he says, easily recognised by shaking the oil with a solution of ferrocyanide of potassium, when a red precipitate (*ferrocyanide of copper*) is formed. To this metal, derived as is supposed from the copper vessels in which the oil has sojourned, M. Guibourt ascribes the green colour of the oil. This conclusion, however, was somewhat premature; for all the samples of the oil which I have examined were, though green, quite devoid of copper; and Mr. Brande observes, that none of the samples which he has examined have contained even a trace of copper.

In 1831, oil of cajuputi was extolled as a remedy for cholera.[5] In consequence of the great demand for it, which was thereby created, the price rose from 2 to 14 shillings per ounce; and various imitations of it soon made their appearance in the market. One of these consisted of oil of rosemary flavoured with camphor and oil of cardamoms, and coloured. Except on this extraordinary occasion, the oil of cajuputi met with in the shops of this country I believe to be pure as imported. [The wholesale price for this oil has for some years past ranged between fourpence and sixpence per ounce.—ED.]

PHYSIOLOGICAL EFFECTS.—Cajuput oil is a powerful antispasmodic diffusible stimulant and sudorific. From the ordinary distilled oils (as those of the labiate plants and umbelliferous fruits) it is distinguished by its stronger influence over the nervous system (evinced by its antispasmodic qualities) and by the greater diffusibility of its stimulant operation. It is allied to valerian, between which and camphor it ought to be placed, in a physiological classification; but in large doses it does not disorder the mental faculties as these two medicines do.

USES.—Cajuput oil has acquired considerable celebrity among the

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[1] *Org. Chem.* 476.

[2] *Dict. of Pharm.*

[3] Quoted by Thomson, *op. cit.*

[4] *Journ. de Chim. Méd.* vii. 612.

[5] *Lond. Med. Gaz.* viii.

Malays; and has been more frequently employed in Germany than in any other European nation. By British practitioners its uses have hitherto been very limited. *As a diffusible stimulant* it is useful where we wish promptly to raise the energy of the vital powers, especially when at the same time any spasmodic movements are to be allayed. With these views it has been employed in low fevers, paralytic affections, and cholera. In the last-mentioned diseases it acquired an ephemeral reputation, in consequence of the favourable reports of Sir Matthew Tierney, and others.[1] *As an antispasmodic,* it is a very efficacious remedy, in painful spasmodic affections of the stomach, and in flatulent colic; but of its uses in epilepsy, chorea, hysteria, tetanus, spasmodic asthma, and some other spasmodic diseases, in which its efficacy has been extolled by oriental and continental practitioners, I have no experience. *As a stimulating sudorific,* it proves occasionally useful in chronic rheumatism, painful affections, and local paralysis. As an *anthelmintic,* it was used by Rudolphi.

ADMINISTRATION.—The dose of it is from 2 to 10, or even more, drops. It may be taken on sugar, or in the form of an emulsion.

262. CARYOPHYLLUS AROMATICUS, *Linn. L. E. D.*—THE CLOVE TREE.

Sex. Syst. Icosandria Monogynia.

(Flos nondum explicatus; Oleum è flore nondum explicato destillatum, *L.*—Dried undeveloped flower; Volatile oil of the undeveloped flowers, *E.*—Flores nondum explicati, et Oleum volatile, *D.*)

HISTORY.—The *garyophyllon* of Pliny[2] cannot have been our clove, since this naturalist describes it as being like a peppercorn, but larger and more brittle. Indeed, it is not certain who first speaks of the clove. Paulus Ægineta[3] notices καρυόφυλλον, and, I think, probably refers to the clove; though Sprengel[4] regards Simeon Seth as the first who mentions cloves.

BOTANY. **Gen. Char.**—Tube of the *calyx* cylindrical; limb 4-partite. *Petals* 4, adhering by their points in a sort of calyptra. *Stamens* distinct, arranged in four parcels, inserted in a quadrangular fleshy hollow near the teeth of the calyx. *Ovary* 2-celled, each cell containing 20 ovules. *Berry,* when ripe, 1- or 2-celled, 1- or 2-seeded. *Seeds* cylindrical or semi-ovate; *cotyledons* thick, fleshy, concave externally, sinuous in various ways internally; *radicle* arising from the centre of the cotyledons, straight, superiorly hidden by the cotyledons.—*Trees. Leaves* opposite, coriaceous, dotted. *Cymes* terminal or in the forking of the branches; somewhat corymbose (De Cand.)

Sp. Char.—*Leaves* obovate-oblong, acuminate at both ends. *Cymes* many-flowered (De Cand.)

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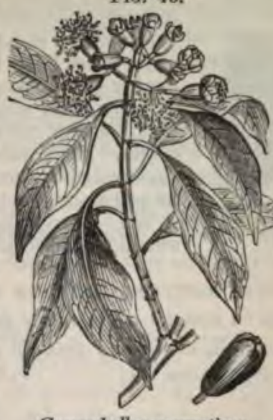
[1] *Lond. Med. Mag.* vol. viii. pp. 628, 683, 736, &c.

[2] *Hist. Nat.* lib. xii. cap. 15, ed. Valp.

[3] *De re medica,* lib. vii. cap. 3.

[4] *Hist. rei herb.* i. 217.

FIG. 45.



Caryophyllus aromaticus.

Trunk from 15 to 30 feet high. *Leaves* about 4 inches long, with a strong midrib and parallel lateral nerves; footstalks slender, aromatic; almost 2 inches long. *Flowers* odorous. *Calyx* at first green, afterwards purplish-red. *Petals* 4, larger than the calyx, imbricated into a globe in bud, at length spreading, roundish, concave, yellowish-red, very soon caducous. In the centre of the calyx, and occupying the top of the ovary, is a quadrangular elevated line (or *gland*) surrounding, but not embracing, the base of the shortish, obtusely subulate *style*. *Filaments* much longer than the petals, yellow: *anthers* ovate-cordate, yellow, two-celled. *Ovary* oblong, or almost cylindrical. *Berry* purplish, elliptical, 1-seeded. *Seed* with a thin, soft integument; *embryo* elliptical, greenish, dotted (Condensed from *Bot. Mag.* t. 2749.)

HAB.—Molucca Islands; where, as well as at Sumatra, Mauritius, Bourbon, Martinique, and St. Vincent's, it is now extensively cultivated. The short-sighted and selfish policy of the Dutch, to limit the cultivation of the plant to the Molucca Islands, has, therefore, completely failed.[1] [The best come from Amboyna, and are shipped at Penang, in Sumatra.—ED.]

COLLECTION.—Cloves are collected by the hand, or beaten with reeds, so as to fall upon cloths placed under the tree, and dried by fire, or, what is better, in the sun.

COMMERCE.—They are imported in casks or bags. Those produced in the Molucca Islands usually come by way of Rotterdam. In 1839 duty (6d. per lb.) was paid on 93,549 lbs.

DESCRIPTION.—The clove of commerce (*caryophyllus*) is the unexpanded flower, the corolla forming a ball or sphere at the top, between the four teeth of the calyx, and thus with the tapering, somewhat quadrangular tube of the calyx, giving the appearance of a nail (whence the word *clove*, from the French *clou*, a nail). The length of the clove is from five to ten lines; its thickness from 1 to 1-and-a-half lines. Its colour is dark brown with a yellowish-red tint; the corolla somewhat deeper. Good cloves should be dark brown, and perfect in all parts, have a strong fragrant odour, and a hot acrid taste, and, when slightly pressed with the nail, give out oil. They are distinguished in commerce by their place of growth. Those from the East Indies (*Amboyna* and *Bencoolen cloves*) are the best: they are the largest, plumpest, and most oily. The *Bencoolen clove* is the most esteemed. Cloves produced in the French possessions (*Bourbon* and *Cayenne cloves*) are smaller, more shrivelled, contain less oil, and are of inferior value. The *Cayenne clove* is the least esteemed.

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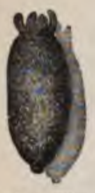
[1] See Marsden, *History of Sumatra*, 3d edit. p. 146; Smith, in Rees' *Cyclop.* art. *Caryophyllus*; Crawford, *East. Archip.* iii. 388; Hooker, *Bot. Mag.* t. 2749.

FIG. 46.



Mother Clove.

Under the name of MOTHER CLOVES (*matrices caryophylli* seu *anthophylli*) are described, in several authors, the fruits of the clove (*fructus caryophylli aromatici*) which have occasionally been introduced as articles of commerce, and a sample of which has been preserved in the collection of the East India House. On the 8th of February, 1841, five bags of mother cloves were put up for sale in London. They have the shape of an olive, than which they are smaller. Superiorly they are crowned with the four teeth of the calyx, with the remains of the style in the centre. Their colour is similar to that of the clove: their odour and flavour similar, but much weaker. Internally we find the embryo with its two sinuous cotyledons.

The broken peduncles of the clove (*clove stalks; griffe de girofle*) are sometimes substituted by distillers for cloves (Guibourt).

COMPOSITION.—Cloves were analysed by Trommsdorff,[1] who found them to consist of, *volatile oil* 18, *almost tasteless resin* 6, *peculiar kind of tannin* 13, *difficultly soluble extractive with tannin* 4, *gum* 13, *woody fibre* 28, and *water* 18.

1. VOLATILE OIL (See *post*).

2. EUGENIN *Stéaroptène of Oil of Cloves.*)—This was found in oil of cloves by Bonastre. It is in thin, white, pearly scales, which become yellow by keeping. It is very soluble in alcohol and ether; has the odour and taste of cloves, but weaker, and is reddened by nitric acid. According to Dumas, its composition is *Carbon* 72·25, *Hydrogen* 7·64, *Oxygen* 20·11; or $C^{20}H^{12}O^{4}$.

3. CARYOPHYLLIN (*Clove sub-resin*).—First described by Lodibert[2] and afterwards examined by Bonastre.[3] It is extracted from cloves by alcohol. The Molucca cloves yield the largest quantity of it; those of Bourbon contain less; and the Cayenne cloves none. It is a satiny, crystalline, odourless, tasteless, fusible and volatile substance; insoluble in water, soluble in alcohol and ether; slightly so in caustic alkalies. It is reddened by sulphuric acid. According to Dumas[4] it is composed of *Carbon* 79·5, *Hydrogen* 10·5, *Oxygen* 10·0; hence its formula is $C^{20}H^{16}O^{2}$; so that its composition is similar to that of camphor. [Dr. Sheridan Muspratt has lately examined the constitution of caryophyllin, and has arrived at the same result as Dumas. Dr. M. also believes cloves to contain a peculiar acid, which he has not yet sufficiently investigated.—ED.]

4. CLOVE-TANNIN.—The tannin of cloves is less acerb than ordinary tannin, and its compound with gelatine has less elasticity.

CHEMICAL CHARACTERISTICS.—Nitric acid reddens infusion of cloves. Tincture of sesquichloride of iron renders it blue. The oil of cloves also undergoes similar changes to the infusion. These facts deserve especial attention in relation to opium and morphia (see OPIUM) on account of the analogous phenomena presented by morphia when acted on by nitric acid and sesquichloride of iron.[5] Infusion and oil of allspice are similarly affected.

PHYSIOLOGICAL EFFECTS.—Cloves have a very agreeable flavour and odour, and are devoid of the fiery taste and acridity which distinguish pepper and ginger: in other respects their effects agree with those of other spices. Though volatile oil is by far the most important of their active principles, yet the tannin, extractive, and resin, must contribute something to their operation.

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[1] Gmelin, *Handb. d. Chem.* ii. 1272.

[2] *Journ. de Pharm.* xi. 101.

[3] *Ibid.* p. 103.

[4] *Ann. de Chim. et Phys.* liii. 164.

[5] *Journ. de Pharm.* xi. 539 and 566.

USES.—Cloves are principally used for culinary purposes, as flavouring ingredients. They are not employed in sufficient quantity to prove of much importance as condimentary stimulants, yet they are applicable as gastric excitants, in dyspeptic cases connected with relaxation of the alimentary canal. In medicine cloves are rarely employed alone, or as the basis or principal medicine, but usually as an addition to other medicines, the flavour of which they improve, or whose operation they correct. When, however, they are given alone, it is merely as a stomachic and carminative, to relieve nausea, vomiting, flatulence, or some allied stomach disorder. Distillers prepare a liqueur called *cloves*.

ADMINISTRATION.—In substance cloves may be taken in doses of 5 or 10 grains, or *ad libitum*.

1. **INFUSUM CARYOPHYLLI**, L. E. D.; *Infusion of Cloves; Clove Tea.* (Cloves, bruised, ʒiij. [ʒij., *D.*]; Boiling [distilled, *L.*] Water Oj. [ʒix.] Macerate for 2 hours [1 hour, *D.*] in a vessel covered lightly, and strain [through calico, *E*])—Aromatic, stimulant, and stomachic. Employed in dyspepsia, flatulent colic, and gout; generally in combination with other medicines. Ammonia increases its efficacy.—Dose, f℥j. to f℥ij.

2. **OLEUM CARYOPHYLLI**, L. E.; *Oil of Cloves.* (Obtained by submitting cloves, with water, to repeated distillation).—No directions are given by the London College for the preparation of oil of cloves, which is placed among the articles of the Materia Medica. The Dublin College gives general directions for its preparation from the dried undeveloped flowers.

To extract the whole of the oil from cloves, they must be subjected to repeated cohobations. On an average they yield from 17 to 22 per cent. of volatile oil (including the heavy and light oils). By distillation with water, cloves yield two volatile oils—one lighter, the other heavier, than water. Mr. Whipple informs me, that by the ordinary modes of distillation the heavy oil comes over first. The oil of cloves of commerce is a mixture of these two oils. When carefully and recently prepared it is colourless or light-yellow, but by keeping becomes brownish-red. It has a hot, acrid taste, and the well-known odour of cloves, and is soluble in alcohol, ether, concentrated acetic acid, and the fixed oils. Its sp. gr. is probably variable, though always greater than that of water. Lewis found it to be 1·034. Bonastre[1] says, that of the unrectified oil is 1·055, but by rectification part of the light oil is lost, and the sp. gr. is then 1·361. Ettling[2] says its composition is, *Carbon* 74·6279, *Hydrogen* 8·1531, and *Oxygen* 17·2189. To separate it into the two oils he mixed it with potash ley, and distilled: a *light oil* passed over, while a compound of the *heavy oil* (*clove acid*) and potash remained in the retort, and, by distillation with phosphoric or sulphuric acid, gives out the heavy oil.

a. *Light Oil of Cloves* (*Clove Hydro-Carbon*).—Colourless. Sp. gr. 0·918. Incapable of combining with bases, but absorbing hydrochloric acid gas without yielding a crystalline compound. It consists of $C^{20}H^{8}$; hence it is isomeric with oil of turpentine.

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[1] *Ann. de Chim. et Phys.* xxxv.

[2] *Poggendorff's Annal.* xxxi. 526.

β. *Heavy Oil of Cloves* (*Clove Acid; Caryophyllic Acid; Eugenic Acid*).—It is colourless when recently prepared, but becomes coloured by age. Its sp. gr., according to Bonastre, is 1·079. It combines with alkalies to form crystalline salts (*alkaline caryophyllates* or *eugenates; clove-oil alkalies*). If a salt of iron be added to one of these, it yields a blue, violet, or reddish compound (*a ferruginous caryophyllate*), varying somewhat according to the nature of the ferruginous salt used: thus the protosulphate of iron yields a lilac, the persulphate a red, which becomes violet and afterwards blue: while the sesquichloride gives a vinous tint, which turns to red (Bonastre). Nitric acid reddens caryophyllic acid.

The composition of caryophyllic acid is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Ettling.*	*Boeckmann.*
Carbon	24	144	72·36	72·6327	72·696
Hydrogen	15	15	7·54	7·4374	7·434
Oxygen	5	40	20·10	19·9297	19·870
Clove Acid	1	199	100·00	99·9998	100·000

This statement does not agree with that of Dumas, who from his first analysis[1] gave the formula $C^{20}H^{13}O^{5}$; and from his second one[2], $C^{20}H^{12}O^{5}$. But various reasons, not necessary here to enumerate, lead me to believe that Ettling's formula is the correct one, supported as it is by Boeckmann's analysis and by Dumas's statement, that the sp. gr. of the vapour of caryophyllic acid is 6·4.[3]

The oil of cloves is sometimes placed in the hollow of a carious tooth, to relieve toothache; but its more frequent medicinal use is as an addition to purgatives (e. g. *Pilulæ colocynthidis*, E.) to check nausea and griping.—The dose of it is from 2 to 6 drops. Distillers and soap-makers extensively use oil of cloves.

3. **TINCTURA CARYOPHYLLI**; *Tincture of Cloves.* (Cloves, ℥j.; Rectified Spirit, ℥iv. Macerate for seven days, and then filter).—Though not contained in any of the British pharmacopœias, this a very useful and elegant preparation, and has a place in the French Codex. A solution of the oil in spirit is less agreeable, and becomes milky on the addition of water.—Dose, ♏x. to f℥j. It may be usefully employed as an addition to purgative, stomachic, and tonic mixtures.

263. EUGENIA PIMENTA, *De Candolle, E.*—THE COMMON ALLSPICE.

(Myrtus Pimenta, *Linn. L. D.*)
Sex. Syst. Icosandria Monogynia.
(Fructus immaturus, *L.*—Unripe berries, *E. D.*)

HISTORY.—It is scarcely probable that the ancients should have been acquainted with *allspice*, which is a native of the West Indies, and therefore could not have been known to Europeans before the discovery of America. Yet Clusius[1] thought that it was the *garyophyllon* of Pliny;[2] an opinion, however, which, for the above-mentioned reason, can scarcely be correct.[3]

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[1] *Ann. de Chim. et Phys.* liii. 164.
[2] *Pharm. Central-Blatt*, Oct. 13, 1838: from *Ann. de Pharm.* xxvii. 151.
[3] *Ibid.*; also Thomson's *Org. Chem.* p. 1046.

BOTANY. **Gen. Char.**— Tube of the *calyx* roundish; limb divided as far as the ovary, into four segments. *Petals* as many as the lobes. *Stamens* indefinite, free. *Ovary* 2- or 3-celled; cells containing many ovules. *Berry* nearly globose, crowned by the calyx; when ripe 1-, rarely 2-celled. *Seeds* one or two, somewhat rounded, large; *embryo* spuriously monocotyledonous; *cotyledons* very thick, combined into one mass; *radicle* scarcely distinct, very short (De Cand.) — *Trees* or shrubs.

Sp. Char.—*Peduncles* axillary and terminal, trichotomous-paniculate. *Flowers* 4-cleft, in the forks of the peduncle, nearly sessile, others paniculate. *Leaves* oblong or oval, pellucid-dotted, somewhat opaque, smooth. *Branches* terete; branchlets compressed; the younger ones, as well as the pedicels, pubescent (De Cand.)

Trunk about 30 feet high. *Leaves* about four inches long, on short foot-stalks. *Flowers* numerous. *Sepals* roundish. *Petals* reflected, greenish-white. *Berry* succulent, black or dark purple when ripe; 2-seeded. *Embryo* roundish, with the cotyledons consolidated.[4]

Hab.— West Indies. It is cultivated in Jamaica in regular walks (*Pimento walks*).

COLLECTION. — When the fruit has attained the full size, but is yet green, it is gathered and sun-dried on platforms and sheets. When nearly dry it is frequently winnowed. It is afterwards put in bags of 1 cwt. each, for the European market.[5] Some planters kiln-dry it.

DESCRIPTION. — *Pimento* or *Jamaica pepper* (*pimenta* seu *piper jamaicense*), commonly called *allspice* (because its flavour is considered to approach that of cinnamon, cloves, and nutmegs), is about the size of, or somewhat larger than, a peppercorn. It is round, brown, dull, roughish but not wrinkled, crowned with the segments of the calyx, and occasionally, though rarely, has a short pedicel. It consists of an external, somewhat hard but brittle shell, which is paler within, and encloses two dark brown cochleate seeds. Allspice has an aromatic agreeable odour (intermediate between pepper and cloves), and a strong aromatic clove-like taste.

OVATE PIMENTO (*Brasilianischer* oder *Kron-Piment*, Dierbach[6]; *Piment couronné* ou *Poivre de Thevet*, Guibourt[7]).—This is the fruit of *Myrtus pimentoides*, Nees v. Esenbeck[8], called by De Candolle[9] *Myrcia pimentoides*, a native of the West Indies. Except in shape, it strongly resembles the common allspice. It is ovate or oval, terminated superiorly by a large crown, formed by the 5-toothed limb of the calyx. It is usually 2-, more rarely 3- or 4-celled, each cell containing one seed. Guibourt has always found three, four, or six seeds in each fruit. In the only sample I have seen, and which came from St. Vincent's, there were in most of the fruits only two seeds.

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[1] *Exotic.* lib. i. cap. 17.
[2] *Hist. Nat.* lib. xii. cap. 15, ed. Valp.
[3] Sloane's *Jamaica*, ii. 77.
[4] Condensed from *Botanical Magazine*, t. 1236.
[5] Wright, *Med. Plants of Jamaica*; Brown, *Nat. Hist. of Jamaica*, 248.
[6] *Berlin. Jahrbuch*, Bd. xxxviii. S. 296.
[7] *Hist. des Drog.* ii. 351.
[8] *Icones Plant. Med.*
[9] *Prodr.* iii. 243.

COMMERCE.—Pimento is imported in bags, usually from the West Indies (almost entirely from Jamaica). In 1839, duty (9d. per lb.) was paid on 277,185 lbs.

COMPOSITION.—Pimento was analysed by Braconnot,[1] and in 1825 by Bonastre.[2]

Bonastre's Analysis.

	Husks.		Kernels.
Volatile oil	10·0	...	5·0
Green oil	8·4	...	2·5
Solid fat oil	0·9	...	1·2
Astringent extract	11·4	...	39·8
Gummy extract	3·0	...	7·2
Colouring matter	4·0	...	...
Resinous matter	1·2	...	...
Uncrystallisable sugar	3·0	...	8·0
Malic or gallic acid	0·6	...	1·6
Lignin	50·0	...	...
Saline ashes	2·8	...	1·9
Water	3·5	...	3·0
Loss	1·6	...	1·8
Red matter, insoluble in water	...	...	8·8
Pellicular residue	...	...	16·0
Brown flocculi	...	...	3·2
Total	100·0	...	100·0

Braconnot's Analysis.

Volatile oil	1·9
Amylum	9·0
Wax, with red colouring matter	0·9
Gum	6·0
Nitrogenous matter	5·0
Citrate of Potash	6·0
Phosphate of Potash and loss	3·4
Insoluble matter	67·8
Total	100·0

1. VOLATILE OIL. (See *post.*)

2. GREEN OIL (*Resin?*)—This substance, which has an acrid burning taste, contributes to the activity of pimento. Its odour is rancid, but somewhat clove-like. It dissolves readily in alcohol and ether, to which it communicates a green colour.

3. PIMENTO-TANNIN.—Is soluble in alcohol, strikes a green colour with the persalts of iron, and precipitates emetic tartar.

CHEMICAL CHARACTERISTICS.—See *Chemical Characteristics* of cloves.

PHYSIOLOGICAL EFFECTS.—Allspice possesses the general properties of the species already noticed. It holds an intermediate rank between pepper and cloves.

USES.—Its principal employment is by the cook for flavouring. It may be taken with advantage by those troubled with relaxed or atonic conditions of stomach. In medicine, its uses are similar to those of cloves; viz. to relieve flatulency, to cover the flavour of nauseous remedies, and to promote the operation of tonics and stomachics, and to prevent the griping of purgatives.

ADMINISTRATION.—In substance, allspice may be taken in doses of from ten grains to a drachm or more.

1. OLEUM PIMENTÆ, L. E. D.; *Oil of Pimento; Oil of Allspice.* (Obtained by submitting allspice, bruised, with water, to distillation).—

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[1] Duncan, *Edinb. Dispens.*

[2] *Journ. de Chim. Méd.* i. 210.

Mr. Whipple informs me that from 8 cwt. of pimento he procured 41 lbs. 6 oz. of oil (heavy and light). This is nearly 6 per cent. He also informs me that the light oil comes over first,—the reverse being the case with oil of cloves. The oil of pimento of the shops is a mixture of these two oils. Except in odour, its properties are almost identical with those of oil of cloves. By distillation with caustic potash, the *light oil* is separated: the residue, mixed with sulphuric acid and submitted to distillation, gives out the *heavy oil.*

α. *Light Oil of Pimento* (*Pimento-Hydro-Carbon*).—Has not, to my knowledge, been previously examined. Its properties appear to be similar to those of the light oil of cloves. It floats on water and on liquor potassæ, and is slightly reddened by nitric acid. Potassium sinks in, and is scarcely, if at all, acted on by it.

β. *Heavy Oil of Pimento* (*Pimentic Acid*).—Very similar to caryophyllic acid. It forms with the alkalies, crystalline compounds (*alkaline pimentates*), which become blue or greenish on the addition of the tincture of chloride of iron (owing to the formation of a *ferruginous pimentate*). Nitric acid acts violently on and reddens it.

The medicinal uses of the oil of pimento are very limited. It is sometimes employed to relieve toothache, to correct the operation of other medicines, as purgatives and tonics, and to prepare the *spiritus* and *aqua pimentæ.* The dose of it is from two to six drops.

2. **SPIRITUS PIMENTÆ,** L. E.; *Spirit of Pimento; Spirit of Allspice.* (Oil of Pimento, ʒij.; Proof Spirit, *Cong.* j., *L.*)—The *Dublin College* has not now a Spiritus Pimentæ, but the Essentia Pimentæ is an analogous preparation made by mixing f℥ix. of the oil with f℥ix. of rectified spirit. The *Edinburgh College* directs half a pound of bruised pimento to be used, and to proceed as for spirit of caraway.—Carminative and stomachic. Used in dyspepsia and flatulent colic. Dose, fʒj. to fʒiv. In the shops, a spirituous solution of the oil is frequently substituted for the pharmacopœial preparation.

3. **AQUA PIMENTÆ,** L. E. D.; *Pimento Water; Allspice Water.* (Pimento, bruised, lb. j. [Rectified Spirit, f℥iij., *E.*]; Water *Cong.* ij., *L.* Mix, and let a gallon distil. The *Dublin College* directs one fluidounce of Essence of Pimenta to be mixed with half a gallon of Distilled Water, and the mixture filtered through paper.)—Employed for its flavouring, carminative, and stomachic properties, as a vehicle for stimulant, tonic, and purgative medicines. Dose, f℥j. to f℥ij. In the shops it is usually prepared with the oil, according to the formula of the Dublin College.

OTHER MEDICINAL MYRTACEÆ.

The substance called *Botany Bay Kino* is the astringent inspissated juice of EUCALYPTUS RESINIFERA or *Iron Bark,* a native of Australia and Van Diemen's Land. This tree, we are told[1], sometimes yields on incision sixty gallons of juice. Botany Bay kino is imported in boxes. That which I have met with came from Van Diemen's Island. It occurs in irregular odourless masses, many of which are in the form of tears, somewhat resembling those of cherry-tree gum in form, and as large as the tears of Senegal gum. The purer pieces are vitreous, almost black in the mass, but transparent, and of a beautiful ruby-red in small and thin fragments. Some of the pieces, however, are opaque and dull, from the intermixture of wood and other impurities. When chewed it sticks to the teeth, and has an astringent taste. Digested in cold water it swells, becomes soft and gelatinous (like red-currant jelly), and yields a red liquid, which reddens litmus, and yields precipitates with lime water, gelatin, acetate of lead, sesquichloride of iron, and, if caustic potash or ammonia be previously added, with the chloride of calcium. Alcohol and emetic tartar occasion no precipitate. Digested in rectified spirit, Botany Bay kino becomes gelatinous, as with water, and yields a similar red solution, from which water precipitates nothing, but which reddens litmus, and deposits a copious precipitate when potash, ammonia, or lime-water is dropped in. From these and other experiments, I infer that Botany Bay kino consists principally of a peculiar substance (*Eucalyptin*) analogous somewhat to *pectin* and *tannic acid*. It has been used in diarrhœa.[1] Ainslie[2] says it is the only kind employed in India; but I suspect there is some error in this statement.

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[1] White, *Journal of a Voyage to New South Wales,* p. 231, 1790.

ORDER LXII. LYTHRACEÆ, *Lindley*.—THE LOOSESTRIFE TRIBE.

SALICARIÆ, *Jussieu*.—LYTHRARIEÆ, *De Candolle*.

CHARACTERS.—*Sepals* definite in number, coherent beyond the middle. *Calyx* free, tubular or campanulate; lobes valvate, or distant in æstivation; the sinuses being sometimes lengthened into conical lobes or external teeth. *Petals* inserted on the upper part of the tube of the calyx, between the lobes, various in number, sometimes none, generally very caducous. *Stamens* inserted into the tube of the calyx below the petals; equal, double, triple, or quadruple the number of petals, sometimes fewer. *Anthers* oval, bilocular, adnate. *Ovary* free; *style* filiform; *stigma* capitate. *Capsule* membranous, covered or surrounded by the calyx of 2 to 4 carpels; while young generally (always?) 2-celled by the slender margins of the carpels being inflexed; but when ripe 1-celled by the disappearance of the dissepimenta, either dehiscing longitudinally, or more rarely and irregularly with a circumscissile dehiscence. *Placenta* central, adnate to the dissepiment when present, or free, thick, either compressed-cylindrical or obscurely trigonal or tetragonal; the apex with some threads, conveyers of the seminal aura continuous with the base of the style. *Seeds* many, small, exalbuminous; *embryo* straight; *radicle* turned towards the hilum; *cotyledons* flat, foliaceous (De Candolle).

PROPERTIES.—Variable. Except *Lythrum Salicaria*, which is astringent, the medical properties of few species are well known. Nesæa salicifolia is said to be diuretic, diaphoretic, and purgative.

264. LYTHRUM SALICARIA, *Linn.*—SPIKED PURPLE LOOSESTRIFE.

Sex. Syst. Dodecandria Monogynia.

HISTORY.—As this plant is a native of the Grecian Archipelago, it must have been known to the ancients; but hitherto it has not been satisfactorily identified with any plant described by them.

BOTANY. **Gen. Char.**—*Calyx* cylindrical, striated, toothed at the apex; teeth 8 to 12, of which four to six are broader than the rest, and erect, and the remaining four to six alternate ones, subulate, often horn-shaped, sometimes not present, or very small. *Petals* 4 to 6, arising from the apex of the tube, alternate with the erect teeth. *Stamens* arising from the middle or base of the calyx, double or equal the number of the petals, or by abortion fewer. *Style* filiform; *stigma* capitate. *Capsule* oblong, covered by the calyx, 2-celled, many seeded. *Placentæ* thick, adhering to the dissepiment. *Herbs*, or rarely *undershrubs*. *Leaves* entire. *Flowers* axillary, purple or white (De Cand.)

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[1] White, *op. cit.*
[2] *Mat. Indica.*

Sp. Char.—*Leaves* lanceolate, cordate at the base. *Flowers* spiked, almost sessile (De Cand.)

Stems 2 or 3 feet high, 4-sided. *Spikes* very long. *Flowers* purple. *Petals* oblong, cuneiform. *Stamens* usually 12, of which six are long and six short.

Hab.—Ditches and watery places of this and other countries of Europe, west of Asia, New Holland, and North America.

DESCRIPTION.—The herb (*Herba Salicariæ* seu *Lysimachiæ purpureæ*) when dry, is inodorous, but has an herbaceous, somewhat astringent taste, and by chewing becomes very mucilaginous. Its infusion is darkened by the ferruginous salts.

COMPOSITION.—I am unacquainted with any analysis of this plant. Its obvious constituents are *tannic acid*, *mucilage*, *chlorophylle*, and *woody fibre.*

PHYSIOLOGICAL EFFECTS.—Demulcent and astringent.

USES.—Principally employed in diarrhœa and dysentery. In the former of these complaints it was recommended by Bang,[1] De Haen,[2] and others. In dysentery, it was spoken favourably of by Gardane[3] and others.

ADMINISTRATION.—Dose of the powdered herb ʒj. twice or thrice a day. A decoction of the root, prepared by boiling ℥j. of the root in Oj. of boiling water, may be taken in doses of f℥j. or f℥ij.

[This herb formerly found a place in the Materia Medica of the Dublin College. It is omitted in the last edition of the Pharmacopœia.—ED.]

ORDER LXIII. GRANATEÆ, *Don.*—THE POMEGRANATE TRIBE.

CHARACTERS.—Tube of the *calyx* turbinate; limb 5- or 7-cleft, coriaceous; lobes valvate by æstivation. *Petals* 5 or 7. *Stamens* indefinite; *filaments* free; *anthers* anteriorly 2-celled, dehiscing by a double chink. *Style* filiform; *stigma* capitate, pimpled. *Fruit* large, spherical, crowned with the somewhat tubular limb of the calyx, coated with the tube of the calyx, indehiscent, unequally divided into 2 chambers by a horizontal diaphragm; the upper one 5- or 9-celled, the lower one smaller, 3-celled; the dissepiments of both membranous. *Placentæ* of the upper chamber fleshy, spreading from the sides to the centre; those of the lower chamber irregular processes from its base. *Seeds* innumerable, mixed with a pellucid somewhat crystalline pulp, exalbuminous; *embryo* oblong; *radicle* short, straight; *cotyledons* foliaceous, spirally convoluted.—*Trees* or *shrubs*. *Leaves* deciduous, opposite, oblong, entire, without dots. *Flowers* scarlet (De Cand.)

PROPERTIES.—See *Punica Granatum.*

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[1] *Act. Reg. Soc. Med. Havn.* vol. i. p. 100.

[2] *Rat. Med.* iii. 196; and iv. 250: quoted by Murray, *App. Med.*

[3] *Gazette de Santé*, 1773, p. 65: quoted by Murray.

265. PUNICA GRANATUM, *Linn. L. E. D.*—THE COMMON POMEGRANATE.

Sex. Syst. Icosandria Monogynia.

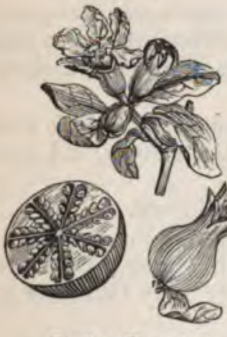
(Fructûs cortex et radicis cortex, *L.*—Root-bark, *E.*—Bark of the root, *D.*)

HISTORY.—The pomegranate is repeatedly referred to in the Bible.[1] Homer[2] also mentions it. The leaves, the flowers, and the fruit, were employed in medicine by the ancients.[3]

BOTANY. **Gen. Char.**—Only one genus. (See the *characters* of the ORDER.)

Sp. Char.—*Leaves* lanceolate. *Stem* arborescent (De Cand.)

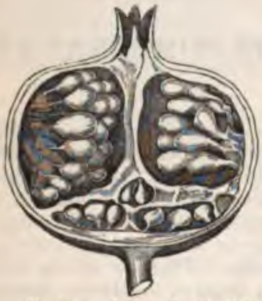
FIG. 47.



Punica Granatum.

Small *tree*, with a brownish bark. *Leaves* on short stalks, smooth. *Flowers* terminal on the young branches. *Calyx* thick, fleshy, red. *Petals* much crumpled, membranous, rich scarlet. *Stamina* numerous, inserted on the calyx; *anthers* yellow. *Ovary* roundish; *style* simple; *stigma* globular. *Fruit* larger than an orange, with a thick coriaceous rind, and crowned by the teeth of the calyx; cells several, arranged in two strata, one upper, the other lower, separated by a transverse diaphragm; lower stratum of 3, upper one of from 5 to 9 cells. Some difficulty having been experienced in comprehending the structure of this anomalous fruit, Dr. Lindley[4] has explained it thus: within the calyx are two rows of carpella, a lower and inner one, consisting of three or four carpella surrounding the axis, and placed in the bottom of the calyx; and an upper and outer one, consisting of from five to ten carpella, surrounding the lower, but adherent to the upper part of the tube of the calyx. The two strata or tiers of cells in the pomegranate are formed by the two rows or tiers of carpella; the upper and outer row being forced to the top of the fruit by the contraction of the tube of the calyx from which they arise. The transverse diaphragm is formed by the adhesion of the upper to the lower stratum of carpella; and the outer part of the rind of the pomegranate is formed by the calyx which contains the carpella.

FIG. 48.



Section of the Fruit of the Punica Granatum, showing the two strata of cells.

Hab.—Northern Africa, from whence it has been introduced into Europe, where it is now naturalised. Asia (Bengal, China, Persia.)

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[1] *Numbers*, xiii. 23; *Deut.* viii. 8, &c.

[2] *Odyss.* vii. 120.

[3] Dierbach, *Arzn. d. Hippokr.* 90; Dioscorides, lib. i. cap. 151–4; Pliny, *Hist. Nat.* xxiii. 57.

[4] *Nat. Syst.* 2d edit. p. 44; and *Introd. to Bot.*

DESCRIPTION.—The *flowers*, called *balaustine flowers* (*flores granati seu balaustiæ*), are odourless, of a fine red colour, and slightly styptic taste. They communicate a reddish colour to the saliva. The *rind of the fruit* (*cortex granati: malicorium*), when dry, occurs in irregular-arched, dry, brittle, odourless, very astringent, and slightly bitter fragments, which are brownish (more or less yellow or reddish), and paler within. The *seeds* (*semina granati*) are each surrounded by a thin vesicle filled with an acidulous styptic juice. The *root* (*radix granati*) is woody, knotty, hard, heavy, of a yellow colour and astringent taste. Its bark (*cortex radicis granati*) occurs in small fragments, of a yellowish- or ash-grey colour externally, yellow within, brittle, not fibrous; of an astringent, but not bitter taste. By its want of bitterness it may be distinguished from the bark of the box-tree (*Buxus sempervirens*), which is said to be sometimes substituted for it. Moistened with water, and rubbed on paper, it leaves a yellow stain, which becomes deep-blue by the contact of sulphate of iron.[1]

COMPOSITION.—Reuss[2] examined the watery extract of the *rind of the fruit*. The *bark of the root* has been analysed by Wackenroder;[3] in 1824, by Mitouart;[4] and, in 1831, by Latour de Trie.[5]

WATERY EXTRACT OF POMEGRANATE RIND.		BARK OF THE POMEGRANATE ROOT.		
Reuss's Analysis.		*Wackenroder's Analysis.*		*Latour de Trie's Analysis.*
Resin	0·92	Rancid fat oil	2·46	Fatty matter.
Tannin	27·78	Tannin	21·92	Tannin.
Oxidised tannin	10·19	Starch with some mucilage of lime	26·09	Gallic acid.
Extractive	21·76			*Granadin* (Mannite).
Gum	34·26	Woody fibre with albumen	45·45	Resin (copious).
Loss	95·0			Wax.
		Loss	4·08	Chlorophylle.
				[Insoluble matters].
Extract of the Rind	100·00	Dried Bark	100·00	Bark of the Root.

1. MANNITE (*Granadin*).—The sweet substance which Latour de Trie considered to be peculiar, and called *granadin*, has been satisfactorily shown[6] to be mannite (see MANNA).

2. TANNIC ACID.—On this the astringency of the fruit and root almost solely depends. It is this principle which enables the infusion, or decoction, of the rind and bark to produce precipitates (*tannates*) with a solution of gelatine, and with the ferruginous salts.

3. RESIN.—Latour de Trie describes this as being without any remarkable odour and taste. It is soluble in water, slightly so in cold alcohol, and more so in hot alcohol, and in small quantity in ether.

PHYSIOLOGICAL EFFECTS.—All parts of the plant (root-bark, rind of the fruit, juice surrounding the seeds, and flowers) possess astringency, owing principally to tannic acid, and in some slight degree to a minute quantity of gallic acid. The bark of the root, taken *in small quantities*, occasions no remarkable effects. *In full doses*, however, it causes nausea, vomiting, and purging, and occasionally giddiness and faintness.

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[1] Guibourt, *Hist. des Drog.* i. 501.
[2] Gmelin, *Handb. d. Chem.* ii. 1272.
[3] *Ibid.*
[4] *Journ. de Pharm.* x. 352.
[5] *Ibid.* xvii. 503—601.
[6] *Ibid.* xxi. 169.

USES.—Rarely employed in medicine. The *root-bark* has been occasionally used as a vermifuge. Celsus, Dioscorides, Pliny, and other ancient writers, speak of its anthelmintic qualities. The Indians, also, were acquainted with them at a very early period. Of late years attention has been again drawn to this bark as a remedy for tape-worm, by the recommendations of Dr. Fleming,[1] Dr. Buchanan,[2] Mr. Breton,[3] Gomes,[4] Deslandes, and others;[5] but in this country it has almost been entirely superseded by oil of turpentine and kousso. The *rind of the fruit* has been employed on account of its astringency, in the form of decoction, as a gargle, in relaxed sore-throat; as an injection, in leucorrhœa; and, internally, in diarrhœa, dysentery, and colliquative sweats. The powder of the rind may be administered as a tonic. The *flowers* are mild astringents, but are not employed in this country. The *fruit* may be eaten to allay thirst, and as a refreshing refrigerant and astringent in febrile disorders, especially those called bilious. It contains an acidulous styptic juice, which is inclosed in a thin vesicle surrounding the seeds.

1. **DECOCTUM GRANATI RADICIS**, L.; *Decoction of Pomegranate Root.*—This is prepared by boiling ℥ij. of the fresh bruised bark in Oij. of water to Oj.: the dose is a wine-glassful every half hour till the whole is taken. It usually occasions slight sickness, but seldom fails to destroy the tapeworm. The patient should be prepared for the remedy by the use of a dose of castor oil and a strict regimen the day previously.

2. **DECOCTUM GRANATI**, L.; *Decoction of the Fruit-bark of the Pomegranate.* (Of the bark of the Fruit, ℥ij.; Distilled Water, Oiss. Boil to Oj. and strain.)

ORDER LXIV. ROSACEÆ, *Jussieu.*—THE ROSE TRIBE.

CHARACTERS.—*Calyx* generally of 5 sepals, cohering at the base to form a tube; therefore 5-lobed, generally persistent, usually free, sometimes adherent to the ovary. *Petals* as many as the sepals, rarely by abortion none, inserted on the calyx, quincuncial in æstivation, generally regular. *Stamens* inserted with the petals, almost indefinite; *filaments* incurved in æstivation: *anthers* two-celled, dehiscing by a double chink. *Carpels* numerous, either solitary by abortion, or having the appearance of a single ovary, from their union, either together or with the tube of the calyx. *Ovaries* 1-celled; *styles* simple, dilated at the apex into *stigmas* of variable shape, usually arising from the side of the ovary, either distinct, or, more rarely, coherent. *Seeds* in each carpel usually one or two, seldom numerous: erect or inverse, exalbuminous (Hirtella and Neillia excepted). *Embryo* straight; *cotyledons* either foliaceous or fleshy. *Herbs*, *shrubs*, and *trees*. *Leaves* alternate, bistipulate at the base, simple or compound. *Inflorescence* various (De Cand.)

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[1] *Asiatic Researches*, vol. xi.

[2] *Ed. Med. and Surg. Journ.* vol. iii. 22.

[3] *Med.-Chir. Trans* vol. xi. p. 301.

[4] *Journ. Complém. des Sciences Méd.* xvi. 24.

[5] Bayle, *Bibl. de Thérap.* i. 313.

PROPERTIES.—The prevailing quality of the Rosaceæ is astringency. This is especially obvious in the root. The tribe Amygdaleæ is distinguished from other rosaceous plants by the poisonous properties of the kernels and leaves, which yield hydrocyanic acid when distilled with water, and by the gummy exudation from the stems.

TRIBE I. AMYGDALEÆ.

266. AMYGDALUS COMMUNIS, *Linn. L. E. D.*—**THE COMMON ALMOND.**

Sex. Syst. Icosandria, Monogynia.

(Semen; Amygdala dulcis; Oleum ab alterutriusque nucleis expressum, *L.*—*Var.* α, Kernel: Bitter almond. *Var.* β and γ, Kernel: Sweet almond, *E.*—Amygdalæ dulces, *D.*)

HISTORY.—Almonds were well known to the ancients; they are mentioned in the earliest part of the Old Testament.[1] Hippocrates employed both the sweet and bitter almonds, and their expressed oil, in medicine.[2] Dioscorides[3] describes the mode of expressing the oil.

BOTANY. **Gen. Char.**—*Drupe* pubescent, velvety; with a fibrous, juiceless cortex, which falls off irregularly; *putamen* (shell) pitted or smooth. *Young leaves* folded flat (conduplicate). *Flowers* somewhat sessile, solitary or in pairs, earlier than the leaves, arising from scaly buds. *Fruit* woolly (De Cand.)

Sp. Char.—*Leaves* oblong-lanceolate, serrulate. *Flowers* solitary. *Calyx* campanulate. *Fruit* ovoid-compressed, tomentose (De Cand.)

A small *tree*. *Leaves* on glandular footstalks, acuminate. *Flowers* moderately large, rose-red or white, nearly sessile, appearing before the leaves. *Calyx* reddish, campanulate, 5-cleft; the segments blunt. *Petals* 5, ovate, irregularly notched, rose-red. *Stamens* numerous (about 30), shorter than the petals, inserted into the mouth of the calyx. *Ovarium* woolly; *style* simple; *stigma* round. *Drupe* ovoid, compressed, leathery, marked with a longitudinal furrow, where it opens when ripe; *epicarp* greenish-grey, tomentose; *mesocarp* (or sarcocarp) fibrous, cracking and dropping off; *endocarp* (*putamen*) woody or almost osseous, oblong or ovate, acute, marked with pits or furrows. *Seed* 1 (rarely 2) in each drupe.

De Candolle[4] admits five varieties of this species:—

α. *amara*. *Bitter Almond.*—*Styles* almost as long as the stamens, tomentose below. *Seeds* bitter—*Flowers* larger; *petals* white, roseate at the base. It varies with a hard and brittle *putamen*.

β. *dulcis*. *Sweet Almond.*—*Leaves* ash-green. *Flowers* earlier. *Styles* much longer than the stamens. *Fruit* ovate compressed, acuminate. *Seeds* sweet. *Putamen* hard.

γ. *fragilis*. *Tender-shelled.* *Flowers* coetaneous. *Petals* broader, quite emarginate. *Leaves* shorter; *petioles* thick. *Fruit* acuminate, sweet. *Putamen* soft.—*Flowers* somewhat roseate.

δ. *macrocarpa*. *Large fruited.*—*Leaves* broader, acuminate, scarcely ash-coloured.

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[1] *Genesis*, xliii. 11.

[2] *Opera*, ed. Fœs. pp. 484, 669, and 413.

[3] Lib. i. cap. 39.

[4] *Prodr.* ii. 530.

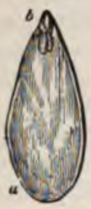
Peduncles shorter, turgid. *Fruit* larger, umbilicated, acuminate at the apex. *Putamen* hard. *Flowers* white-roseate, large, appearing before the leaves. *Petals* broadly obcordate, undulate. It varies—1st, with a lesser fruit called the *Sultana Almond*; 2ndly, with a very small fruit termed the *Pistachio Almond.*

ε. *persicoïdes.* *Peach Almond.*—*Leaves* like those of the peach. *Fruit* oval, obtuse. *Sarcocarp* succulent. *Putamen* yellowish-black. *Seeds* sweet.—On the same branch the *fruit* is sometimes ovate, obtuse, and somewhat fleshy; and dry, ovate-compressed, and acuminate.

Hab.—Barbary and Syria. Cultivated in the southern parts of Europe.

DESCRIPTION.—*Almonds in the shell* (*Amygdalæ cum putamine*) consist of the seed, or kernel (*amygdala*), enclosed in the endocarp (*putamen* or *shell*), which may be hard or soft. The seed is of an oval shape, compressed rounded at one end, and somewhat pointed at the other. The outer covering of the seed (*epidermis seminalis*, Bischoff) is glanduliferous, bitter, of a reddish-brown colour, and veined by the ramifications of the *raphé.* At the pointed extremity of the seed is a small perforation (*foramen*), and on one side of this, at the edge, is the rugged line (*hilum*) which constitutes, botanically, the *base* of the seed. The seed is connected, at the hilum, with the shell by the *umbilical cord.* The larger or round end of the almond is curiously enough termed its apex. That part of the internal seed coat (*endopleura*, De Candolle) which corresponds to the blunt or rounded end of the almond, is dark-coloured, indicating the situation of the *chalaza.* By soaking almonds in warm water, the seed-coats (pellicle or skin) are easily removed. *Blanched almonds* (*amygdalæ decorticatæ*) consist of the *embryo* only, composed of the two large fleshy *cotyledons*, between which, at the pointed extremity of the seed, we observe the *plumule*, with the *radicle* pointing towards the foramen (see fig. 49.)

FIG. 49.



Section of an Almond.
a. One of the cotyledons.
b. Radicle and plumule.

1. Sweet Almonds (*Amygdalæ dulces*).—These are odourless, and have a bland, sweetish, agreeable taste. Three varieties are known in commerce:—"1. *Jordan almonds*, which are the finest, come from Malaga.[1] Of these there are two kinds: the one above an inch in length, flat, and with a clear brown cuticle, sweet, mucilaginous, and rather tough; the other more plump and pointed at one end, brittle, but equally sweet with the former.—2. *Valentia almonds* are about three-eighths of an inch broad, not quite an inch long, round at one end and obtusely pointed at the other; flat, of a dingy-brown colour, and dusty cuticle.—3. *Barbary* and *Italian almonds* resemble the latter, but are generally smaller, and less flattened. [Besides these kinds of almonds, Dr. Pereira, in the *Pharmaceutical Journal*,[2] refers to the —4. *Portugal almonds*, which are smaller than the Valentia, somewhat ovate, but less broad at the lower part: this kind is termed the *Oporto almond*, sold in Provence.—5. The

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[1] See Busby's *Journal of a Recent Visit to the Principal Vineyards of Spain and France*, p. 47, London, 1834.

[2] *Pharm. Journ.* vi. p. 224.

Canary almonds which resemble the Sicily almonds, but are somewhat smaller.—ED.] Rancid, worm-eaten, and broken almonds should be rejected."[1] Sweet almonds are rarely employed for pressing, on account of their greater cost, and the less value of their residual *almond cake* (*placenta amygdalæ dulcis*). *Almond powder* (*farina amygdalæ*) is the ground almond cake, and is employed as a soap for washing the hands, and as a lute.

2. Bitter Almonds (*Amygdalæ amaræ*).—These are brought chiefly from Mogadore. In external appearance they resemble the sweet almond, but are somewhat smaller. [Dr. Pereira (*loc. cit.*) describes also—2. The *French bitter almonds*, which are paler coloured and somewhat larger than the Barbary.[2]—ED.] They are distinguished by their bitter flavour, and, when rubbed with a little water, remarkable odour. They are extensively used for pressing. Their *cake* (*placenta amygdalæ amaræ*) is distilled with water to yield the *volatile oil of bitter almonds*, and is afterwards employed to fatten pigs, and for other purposes.

COMMERCE.—The following table shows the quantity of almonds (bitter and sweet) on which duty was paid during 1838 and 1839[3]:—

	Duty per cwt.	*Quantity on which duty was paid.*	
		In 1839.	In 1838.
Jordan	40s.	1596	1098
Not Jordan	20s.	3576	2200
Bitter	4s.	2145	1870

Almonds are imported in barrels, serons, boxes, and bales.

COMPOSITION.—*Sweet almonds* were analysed by Proust;[4] in 1817 by Boually[5], and in 1825 by Payen and Henry fils.[6]—*Bitter almonds* were analysed by Vogel.[7]

Boullay's Analysis.	
Fixed oil	54·0
Emulsin	24·0
Liquid sugar	6·0
Gum	3·0
Seed-coats	5·0
Woody fibre	4·0
Water	3·5
Acetic acid and loss	0·5
Sweet Almonds	100·0

Vogel's Analysis.	
Volatile oil and hydrocyanic acid	quantity undetermined.
Fixed oil	28·0
Emulsin	30·0
Liquid sugar	6·5
Gum	3·0
Seed-coats	8·5
Woody fibre	5·0
Loss	19·0
Bitter Almonds	100·0

1. **FIXED OIL OF ALMONDS** (See *post*).

2. **EMULSIN** (*Vegetable Albumen of Almonds*).—This remarkable constituent of almonds is white, and soluble in cold water; hence it is a constituent of almond emulsion. From its watery solution it is precipitated in thick white flocks by alcohol; these flocks dissolve in water, even if they have been previously dried. If the watery solution be heated to 212° F. the emulsin coagulates, and the liquor becomes thick, like starch mucilage. From ordinary vegetable albumen, emulsin is distinguished by

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[1] Brande, *Dict. of Pharm.* 55.

[2] *Pharm. Journ.* vi. p. 220.

[3] *Trade List.*

[4] Gmelin, *Handb. d. Chem.*

[5] *Ibid.* vi. 406.

[6] *Journ. de Chim. Méd.* i. 436.

[7] Gmelin, *Handb. d. Chem.* ii. 1268.

its producing the decomposition of amygdalin, and yielding, among other products, the volatile oil of bitter almonds and hydrocyanic acid. When, however, emulsin has been coagulated by heat, it loses its power of acting on amygdalin.[1] The composition of emulsin, according to Mr. Richardson[2], is as follows: —

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Richardson.*
Carbon	24	144	48·81	48·835
Hydrogen	23	23	7·79	7·732
Nitrogen	4	56	18·99	18·911
Oxygen	9	72	24·41	24·722
Emulsin	1	295	100·00	100·200

Boiled with baryta, emulsin evolves ammonia, and yields a barytic salt containing a peculiar acid, which has been termed *emulsic acid.* It is probable, therefore, that emulsin is *an amide of emulsic acid* (*i. e.* emulsate of ammonia, minus an atom of water). Robiquet[3] regards the emulsin of Wöhler and Liebig as a very complex product.

3. AMYGDALIN. — A crystallisable substance found in the bitter, but not in the sweet almond. From four lbs. of bitter almonds Liebig obtained one ounce of pure amygdalin.[4] It is white, odourless, has at first a sweet, then a bitter taste, is very soluble in boiling alcohol and water, but is insoluble in ether. Crystallised out of an alcoholic solution it is in pearly scales, and is anhydrous. The crystals obtained from a watery solution are colourless, transparent, and prismatic, and contain six atoms of water of crystallisation. The watery solution has a feebly bitter taste. Submitted to distillation with nitric acid, it yields hydrocyanic acid, oil of bitter almonds, formic acid, and some benzoic acid. Heated with an alkaline solution it evolves ammonia, and yields an alkaline salt, which contains a peculiar acid called *amygdalic acid*, composed of $C^{40}H^{26}O^{24}+Aq.$; hence, perhaps, amygdalin is *an amide of amygdalic acid* (*i. e.* an amygdalate of ammonia, minus an atom of water). By the action of a solution of emulsin on a solution of amygdalin, we obtain, among other products, hydrocyanic acid and the volatile oil of bitter almonds (see *Volatile Oil of Bitter Almonds*). The following is the composition of amygdalin, according to Wöhler and Liebig: [5] —

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	40	240	52·516
Hydrogen	27	27	5·908
Nitrogen	1	14	3·064
Oxygen	22	176	38·512
Amygdalin	1	457	100·000

In the crystallised state it consists of, 1 atom of *Amygdalin*=457, and 6 atoms of *Water*=54.

4. VOLATILE OIL OF BITTER ALMONDS (see *post*).

PHYSIOLOGICAL EFFECTS AND USES. α. **Of Sweet Almonds.**—Sweet almonds are nutritive and emollient; but on account of the quantity of oil which they contain, they are somewhat difficult of digestion, at least if taken in large quantities, or by persons whose digestive powers are weak. When rancid they are still more apt to disorder the stomach. The husk or pellicle of the almond has been known to occasion nausea, uneasiness in the stomach and bowels, increased heat, œdematous swelling of the face, followed by urticaria. Dr. Winterbottom[6] suffered twice in this way from the use of unblanched sweet almonds, but blanched almonds caused no inconvenience.

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[1] Wöhler and Liebig, *Journ. de Pharm.* xxxiii. 391.

[2] Thomson, *Organ. Chemistry*, 683.

[3] *Journ. de Pharm.* xxiv. 196.

[4] *Handwört. d. Chem.* p. 330.

[5] *Op. cit.*; also *Journ. de Pharm.* xxiii.

[6] *Med. Facts and Observ.* vol. v. p. 60.

For *dietetical* purposes, almonds are employed as a dessert, for puddings, cakes, &c. On account of the irritant qualities of the husk, almonds for the table should always be blanched. Blanched and roasted they have been used as a substitute for coffee.[1] *Medicinally* they are used in the preparation of the *confection*, *emulsion*, and *oil*.

β. **Of Bitter Almonds.**—Bitter almonds are more or less poisonous to all classes of animals. As in the cases of other poisonous vegetable substances, the larger herbivora are much less powerfully affected by them. Thus, three-quarters of a pound of bitter almonds, given to a horse, caused merely dulness and a small pulse.[2] One drachm of bitter almonds has killed some of the smaller animals, as pigeons.[3] Twenty seeds have killed a small robust dog.[4] The symptoms which they induce in animals, are, trembling, weakness, palsy, convulsions (often of the tetanic kind), and, finally, coma. If vomiting occur early, the animal in that way may escape.

In small doses bitter almonds sometimes act on man as irritants to the digestive organs, and occasion nausea, vomiting, and purging. Owing to idiosyncrasy, some individuals are remarkably affected by them. On the late Dr. Gregory they caused, "first, sickness, generally tremors, then vomiting, next a hot fit, with an eruption of urticaria, particularly on the upper part of the body. At the same time the face and head swelled very much, and there was a general feeling like intoxication. The symptoms lasted only a few hours. The rash did not alternately appear and disappear, as in common nettle-rash" (Christison). *In large doses* bitter almonds have caused serious, or even fatal consequences. Pierer[5] mentions that three children having eaten some of these seeds, were attacked in a few minutes with nausea, vomiting, loss of consciousness and of speech, and convulsions. Mr. Kennedy[6] has noticed the case of a stout labourer, who died after the use of a great quantity of bitter almonds. These, and other observations referred to by Wibmer[7], Coullon[8], and others, prove that the poisonous effects of the bitter almond are similar to those of hydrocyanic acid.

The *emulsion of bitter almonds* partakes of the properties of the seeds. Pouzaire (quoted by Wibmer) states that a child of between four and five years of age suffered colic, head affection, grinding of the teeth, trismus, insensibility, and death, from the use of a strong dose of this liquid.

The *distilled water of bitter almonds* (*aqua amygdalæ amaræ*) possesses poisonous properties, when either swallowed or applied externally.[9]

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[1] Murray, *App. Med.* iii. 25.

[2] Viborg: quoted by Wibmer, *Wirk. d. Arzneim. u. Gifte*, i. 157.

[3] Wepfer, *Hist. Cicut. aquat.* p. 298, Lugd. 1733.

[4] Orfila, *Toxicol. Gén.*

[5] Quoted by Wibmer, *op. supra cit.*; also *Lond. Med. Review*, vol. ii. p. 286, Lond. 1800.

[6] *Lond. Med. and Phys. Journ.* lvii. 150.

[7] *Op. supra cit.*

[8] *Recherches*, &c. *sur l'Acide Hydrocyan.* 1819.

[9] See Döltz's experiments, in Wibmer, *op. supra cit.*

Sömmering states that half an ounce of concentrated bitter almond-water killed a dog.[1]

Macaroons and *Ratafia* cakes, as well as *Noyau*, which owe their peculiar flavour to bitter almonds, act injuriously when taken in large quantities.[2] The principal consumption of the bitter almond is for pressing, flavouring, and scenting. For flavouring, the seeds or their essential oil are used by the cook and confectioner.

By medical practitioners in this country, bitter almonds are rarely prescribed. They sometimes enter into the composition of the almond emulsion (see *Mistura Amygdalæ*, Ph. E. D.), but usually as a flavouring ingredient only. They are applicable, however, to all the uses of hydrocyanic acid; as pulmonary affections, gastrodynia, and hooping-cough; but the objection to their use is their varying and uncertain strength. Bergius[3], and subsequently Frank, Hufeland[4], and others, have successfully administered them against intermittent fever. They have also been used to expel tape-worm, and, it is said, with good effect.[5] Pitschaft[6] prescribed bitter almond water to relieve painful menstruation. The emulsion has been employed as a wash to relieve irritation in various skin diseases; as herpes, prurigo, acne, impetigo, &c.

Administration.—Bitter almonds may be taken in substance or emulsion. Kranichfeld[7] employed *the powder of the bitter almond cake* (*farina amygdalæ amaræ*) in doses of 1 to 6 grs. As a substitute for the *distilled water of bitter almonds* (*aqua amygdalæ amaræ*), which is of variable strength, Wöhler and Liebig[8] recommend the following emulsion (*emulsio amygdalæ cum amygdalinâ*) on account of its uniform strength:—Sweet almonds, ʒij.; Water and Sugar sufficient to make f℥j. of emulsion, in which, when strained, dissolve Amygdalin, grs. xvij. This quantity of amygdalin, when acted upon by the emulsion, yields one grain of anhydrous hydrocyanic acid, and 8 grains of volatile oil.—The dose of this emulsion is gtt. x. to fʒj. *Almond paste* is sold in the shops for softening the skin and preventing chaps. Dr. Paris[9] gives the following recipe for making it:—Bitter Almonds, blanched, ℥iv.; the White of an Egg; Rose Water and Rectified Spirit, p. æ., as much as may be sufficient.

1. CONFECTIO AMYGDALÆ, L.; *Conserva Amygdalarum*, E.; *Almond Confection.* (Sweet Almonds, ℥viij.; Powder of Gum Arabic, ℥j.; Sugar, ℥iv. The almonds being first macerated in cold water, and their pellicles removed, rub them through a fine metallic sieve; then beat all the ingredients until thoroughly incorporated. The process of the two Colleges is essentially the same. The *London College* adds, that this confection can be preserved unaltered for a longer time, if the almonds, gum arabic, and sugar, are separately powdered, and afterwards mixed. Then, whenever the confection is to be used, beat all the ingredients together until they are thoroughly incorporated).—Almond confection, prepared without water, is not more apt to spoil or become rancid than when the ingredients are separately powdered, and subsequently mixed; but if, in order to soften the mass, a little water be added, it then soon becomes mouldy or rancid, or both.[1] The only use of almond confection is in the preparation of the emulsion.

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[1] Buchner, *Toxikolog.*

[2] See Virey, *Journ. de Pharm.* ii. 204, for the ill effects of the first of these.

[3] *Mat. Med.* i. 433.

[4] Richter, *Ausf. Arzneim.* ii. 541-2.

[5] Hufeland's *Journ.* Bd. xi. St. 4, S. 179.

[6] Dierbach, *Neuest. Entd. in d. Mat. Med.* Bd. i. 387, 1837.

[7] Dierbach, *op. supra cit.*

[8] *Journ. de Pharm.* xxiii. 415.

[9] *Pharmacologia.*

2. **MISTURA AMYGDALÆ**, L. E. D.; *Lac Amygdalæ; Almond Emulsion; Almond Milk.* (Almond Confection, ℥iiss.; Distilled Water, Oj. Gradually add the water to the confection, while rubbing, until they are mixed; then strain through linen, *L.* The *Edinburgh College* employs ℥ij. of the Confection to Oij. of Water, and strains the mixture through linen or calico; or they direct it to be prepared by the following process: "Sweet Almonds, ℥j. and ʒij.; Pure Sugar, ʒv.; Mucilage, f℥ss.; Water, Oij. Steep the almonds in hot water and peel them, and proceed as for the *Mistura Acaciæ.*"—The *Dublin College* prepares it as follows: Sweet Almonds, blanched, ʒv.; Gum Arabic, in powder, ʒj.; Refined Sugar, ʒij.; Distilled Water, ℥viii. Rub the almonds with the sugar and gum, adding gradually the water, then strain.)—Notwithstanding that the formulæ of the three Colleges are different, none of them precisely agree with that which is in common use. No one who wishes to procure good almond milk would prepare it with the confection, on account of the changes which this preparation suffers by being kept. Powdered gum arabic is, for ordinary purposes, a more convenient and ready ingredient than mucilage, and does not undergo any change by keeping. The following formula, which is similar to that of the Dublin College, yields a preparation identical with that of the London College: Sweet Almonds, ʒiv.: Powdered Gum Arabic, ʒj.; White Sugar, ʒij.; Water, f℥viss. Having blanched the almonds, beat them with the sugar and gum, the water being gradually added.—Almond milk agrees in many of its properties with animal milk. Thus it is white; when examined by the microscope it is seen to consist of myriads of oleaginous globules, suspended in water by the aid of an albuminous principle (emulsin) and sugar; and, lastly, it agrees with milk, in possessing nutritive and emollient qualities. It is used as a demulcent and emollient in pulmonary affections, to appease cough and allay irritation; and in inflammatory affections of the alimentary canal or of the urinary organs. It is an excellent vehicle for other remedies; as for the saline refrigerants (nitre, for example) in febrile cases, for expectorants and paregorics (squills, ipecacuanha, opiates, &c.) in pulmonary affections, for sudorifics (emetic tartar, for example) in febrile and inflammatory cases, for alkalies and their carbonates in affections of the urino-genital organs, and for hydrocyanic acid in gastrodynia and pulmonary disorders. Acids and alcohol (hence tinctures) coagulate the emulsin, and cause almond mixture to separate into a kind of curd and whey; a change which also takes place spontaneously when the

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[1] Brande, *Dict. of Pharm.* 56.

mixture has been kept, and which is accompanied with the development of free acid. In cases where the hydrocyanic acid is admissible, the bitter almond may be used.—The dose of almond emulsion is f℥j. or f℥ij., or *ad libitum.*

3. OLEUM AMYGDALÆ, L.; *Almond Oil; Oil of Sweet Almonds.* (Obtained by expression from either bitter or sweet almonds; usually from the former, on account of their cheapness, as well as of the greater value of their residual cake).—The average produce is from 48 to 52 lbs. from 1 cwt. of almonds. When recently expressed it is turbid, but by rest and filtration becomes quite transparent. It usually possesses a slightly yellow tinge, which becomes somewhat paler by exposure to solar light. It is inodorous, or nearly so, and has a purely oleaginous bland taste. It congeals less readily by cold than olive oil. Braconnot states that at 14° F. it deposits 24 per cent. of *margarine* (*margarate of glycerine*), which fuses at 43° F. The residual *oleine* (*oleate of glycerine*) did not congeal at the greatest degree of cold. The accuracy of these statements has, however, been called in question. Its sp. gr. would appear to vary: Brandis found it 0·911, Brisson 0·917, Saussure 0·920, at 53° F. Sulphuric ether dissolves it. Six parts of boiling, or twenty-five parts of cold alcohol, are required to dissolve one part of this oil.

Proximate Composition.

Braconnot.

Oleine	76
Margarine (Stearine of Braconnot)	24
Almond Oil	100

Ultimate Analysis.

Saussure.

Carbon	77·403
Hydrogen	11·481
Oxygen	10·828
Nitrogen [loss]	0·288
Almond Oil	100·00

The nitrogen mentioned in Saussure's analysis is probably an error.

Almond oil is said to be adulterated with *teel oil.*

It possesses the dietetical and medicinal properties of the other fixed oils. Its local action is emollient. Swallowed in moderate doses it is nutritive, but difficult of digestion. In large doses it acts as a mild laxative.

Almond oil may be employed for the same purposes as olive oil. Mixed with an equal volume of syrup of violets, or syrup of roses, it is given to new-born infants as a laxative. It is sometimes used with gum (in the form of mucilage), alkalies, or yolk of egg, to form an emulsion, which is used in the same cases as the *mistura amygdalæ.* To assist in allaying troublesome cough it is not unfrequently administered in the form of linctus, with confection of dog-rose, and syrup of poppies.

4. OLEUM AMYGDALÆ AMARÆ; *Oleum Amygdalæ amaræ destillatum; Oil of Bitter Almonds; Essential Oil of Almonds.* (Obtained by submitting bitter almond cake [left after the expression of the fixed oil from bitter almonds] to distillation with water, either alone, or more usually with salt. To increase the quantity of volatile oil, Geiger recommended the cake to be macerated in the water for 24 hours before distillation.)—The *theory* of this process is curious. Chemists formerly supposed that the volatile oil resided in the bitter almond, and that by distillation it was merely volatilised and subsequently condensed. But in opposition to this view may be urged the following facts:—

1. Neither bitter almonds, nor their residuary cake, yield any volatile oil by pressure, yet we know that the volatile oil is soluble in the fixed oil, and, therefore, when the latter was expressed it ought to contain traces of the volatile oil, if this existed in the bitter almonds.
2. They yield no oil when digested in alcohol or in ether, though the volatile oil is soluble in both of these liquids.
3. Alcohol extracts from bitter almond cake, sugar, resin, and *amygdalin*. When the latter substance has been removed, the cake is no longer capable of furnishing the volatile oil by distillation.
4. Ether extracts no amygdalin from bitter almond cake; and the cake left after digestion in ether yields the volatile oil by distillation with water.

These facts, then, prove that the volatile oil does not reside in the bitter almond, but is formed by the action of water on some of the constituents of these seeds. When bitter almonds are deprived of amygdalin, they are incapable of yielding the volatile oil: so that it is this principle which enables them to yield it. But amygdalin, with water only, produces no oil: hence the presence of some other substance is necessary. Wöhler and Liebig[1] have shown that this other substance is emulsin, and that, by the mutual reaction of amygdalin, emulsin, and water, we obtain the volatile oil of bitter almonds and hydrocyanic acid. But it appears that sugar, and some other substance (probably a compound of formic acid and altered emulsin), are simultaneously developed. These ingredients are, probably, all yielded by the amygdalin, the operation of emulsin on which has been compared to that of yeast on sugar and water. It will be seen by the following table (drawn up by Wöhler and Liebig), that amygdalin contains the elements of hydrocyanic acid, volatile oil of bitter almonds, sugar, formic acid, and water:—

	Atoms of			
	Carbon.	*Hydrogen.*	*Nitrogen.*	*Oxygen.*
1 atom of hydrocyanic acid	2	1	1	0
2 atoms of volatile oil of bitter almonds	28	12	0	4
1 atom of sugar	6	5	0	5
2 atoms of formic acid	4	2	0	6
7 atoms of water	0	7	0	7
1 atom of Amygdalin	40	27	1	22

The essential oil of bitter almonds of the shops possesses the following properties. It is highly poisonous, has a golden-yellow colour (by rectification it may be rendered temporarily colourless), an agreeable odour (usually compared to that of hydrocyanic acid, but which, in fact, bears but little resemblance to it), and an acrid, bitter taste. It is combustible, and burns with a white flame. Its sp. gr., though always greater than that of water, probably varies somewhat. I find that a sample, which had been prepared for about eight months, had the sp. gr. of 1·0836. It is soluble in alcohol and ether. Oil of vitriol forms with it a magnificent crimson-red thick liquid, which, on the addition of water, yields a yellow emulsion.

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[1] *Journ. de Pharm.* xxiii.

[Some recent observations by Mr. Redwood[1] show that the sp. gr. of this oil varies greatly according to the temperature at which it is obtained; he examined specimens of sp. gr., 1052·4 to as high as 1082·2. This variation has sometimes been attributed to the presence of spirit added for adulteration; but no spirit could be detected. The oils of lighter sp. gr. appeared to contain the purest hydruret of benzule; while, from the reaction of strong sulphuric acid, it would appear that benzoine is present in considerable proportion in the heavier specimens.—ED.]

Oil of bitter almonds, as found in commerce, is a mixture or compound of *hydruret of benzule, hydrocyanic acid,* a little *benzoic acid, benzoine, benzimide,* and probably other substances.

α. HYDRURET OF BENZULE.—This is obtained by forming the oil into a thin paste with hydrate of lime, chloride of iron, and water, and redistilling. It is a limpid colourless oil, whose sp. gr. is 1·043, and whose odour and taste are scarcely different from those of the ordinary oil. Robiquet found it innocuous, but Vogel, and more recently Liebig, declare that it still retains its poisonous properties. In some earlier experiments which I made on this subject I found it to be highly poisonous, though I could not detect an atom of hydrocyanic acid in it. After the sample had been kept a few months, however, I readily detected the acid in it by the potash and iron test. By a second and third rectification I completely deprived it of all traces of the acid; and I then found that four drops of it, given to a small rabbit, had no more effect than the same quantity of any other volatile oil: that is, the animal appeared dull for a few minutes, and the respiration was quickened. Hydruret of benzule is composed of $C^{14}H^{6}O^{2}$. Certain changes which it undergoes are best explained by assuming that this oil is a compound of the base of benzoic acid and hydrogen. To this base, whose composition is $C^{14}H^{5}O^{2}$, the name of *Benzule* or *Benzoyl* Bz, has been given; so that the oil is the *hydruret of benzule*, $C^{14}H^{5}O^{2}+H$ or BzH, and its proximate and ultimate composition is as follows:—

Proximate Composition.

	Atoms.		*Eq. Wt.*
Benzule	1	...	105
Hydrogen	1	...	1
	—		——
Hydruret of Benzule	1	...	106

Ultimate Composition.

	Atoms.		*Eq. Wt.*		*Per Cent.*
Carbon	14	...	84	...	79·24
Hydrogen	6	...	6	...	5·66
Oxygen	2	...	16	...	15·10
	—		——		——
......	1	...	106	...	100·00

By exposure to the air it absorbs 2 eq. oxygen, and is converted into hydrated benzoic acid, $C^{14}H^{5}O^{3}+$ Aq. or BzO,HO.

β. HYDROCYANIC ACID.—The presence of hydrocyanic acid in the essential oil of bitter almonds may be detected by the usual tests, especially by potash and a salt of iron. The quantity of this acid is differently stated by different authorities, and is, probably, not uniform. Schrader[2] got, from an old sample, 8·5 per cent., and from a new sample, 10·75; but Göppert obtained, from another specimen, so much as 14·33 per cent. Water in which the oil has been washed gives evidence of the presence of hydrocyanic acid by the potash and iron test before referred to. [For the preparation and properties of this acid, see *post.*]

γ. BENZOIC ACID, BzO.—This is formed by the action of the oxygen of the atmosphere on hydruret of benzule, as above mentioned. It is more readily produced in the pure hydruret than in raw oil of bitter almonds.

δ. BENZOIN; *Camphor of Oil of Bitter Almonds.*—Liebig[3] states that this is a constituent of oil of bitter almonds. It is a crystalline substance usually obtained by the action of alkalies on the oil. It cannot be procured from hydruret of benzule (with which it is isomeric) unless hydrocyanic acid be present. It is soluble in boiling alcohol. Oil of vitriol also dissolves it with a violet-blue colour; if the solution be heated it becomes brown, green, and at last black, with disengagement of sulphurous acid.

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[1] *Pharm. Journ.* vol. xi. p. 486.

[2] Quoted by Dr. Christison, *Treat. on Poisons.*

[3] Turner's *Chemistry*, 7th edit. p. 785.

ι. **BENZAMIDE.**—This separates from oil of bitter almonds under certain circumstances. Its formula is $C^{14}H^{7}NO^{2}$ or BzAd. It is soluble in alcohol. Nordhausen sulphuric acid dissolves it, assuming a deep indigo colour: if moisture be present the colour is at first emerald green. By the action of potash and a little alcohol it evolves ammonia and forms benzoate of potash.

A *crystalline matter* is frequently deposited by oil of bitter almonds, when it has been kept for some time. Exposure to the air, by which the oil is enabled to absorb oxygen, and the removal of hydrocyanic acid from the oil, facilitate the deposition. In 1822, Grischow and Bahlmann,[1] and, in 1823, Stange,[2] declared the crystals to be those of benzoic acid; a statement which was confirmed, in 1830, by Robiquet and Boutron.[3] I have met with three kinds of crystalline deposit, differing essentially from each other and from benzoic acid.

1st. One of these is characterised by the *emerald-green* colour which it produces when dropped into oil of vitriol. In a few minutes, however, the green changes to red. This deposit is orange-yellow, soluble in boiling water, alcohol, and ether; when the alcoholic or ethereal solutions cool, numerous white, light, pearly crystalline plates (resembling crystalline boracic acid) are deposited. If these white crystals be dropped into oil of vitriol, they also become emerald-green, but very slightly so: the mother liquor is rendered much more intensely green by oil of vitriol. Boiled with caustic potash they give out ammonia. By keeping for two years in a stoppered bottle, both the raw and purified crystals lost the property of becoming green by oil of vitriol: they now became red on the addition of this liquid; and the crystals, on being redissolved in alcohol and recrystallised, were scarcely coloured on the addition of oil of vitriol.

From raw oil of bitter almonds washed with solution of potash I have obtained, at the end of twenty-four hours, crystals which, like the above, became green on the addition of oil of vitriol.

2nd. A second crystalline deposit is characterised by the *cherry-red* colour which it assumes when dropped into oil of vitriol, and by its not evolving ammonia when boiled with caustic potash. Its appearance resembles solid oil of anise. When dissolved in boiling alcohol and re-crystallised, it yields silky prismatic crystals somewhat similar to those of nitrate of ammonia. At the end of two years it had almost lost its quality of being reddened by oil of vitriol; but when boiled with this liquor it gave out a crystalline sublimate. Heated with solution of potash it evolved faint traces of ammonia.

3rd. The third[4] kind of deposit I did not receive until after it had been digested in alcohol. A short notice of it has been given by Dr. Letheby.[5] The crystals are small, acicular, and lemon-yellow; they dissolve in oil of vitriol, forming a *yellow* or *orange-coloured* solution. They are insoluble in water and alcohol. When heated they fuse, but, unlike the two preceding deposits, do not sublime. They do not evolve ammonia when heated with a solution of caustic potash. At the end of two years these crystals were unchanged. In all the cases in which they are found the oil had been put aside contaminated with water.

The *volatile oil of bitter almonds* is a most potent poison, acting as rapidly as the ordinary hydrocyanic acid of the shops, and giving rise to similar symptoms. A single drop has killed a cat in five minutes.[6]

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[1] *Berl. Jahrb. d. Pharm.* 1832, p. 158.

[2] Buchner's *Repert.* xiv. 329; xvi. 82.

[3] *Ann. de Chim. et de Phys.* xliv. 364.

[4] For specimens of this, as well as of the first kind of deposit, I am indebted to Mr. Whipple.

[5] *Lond. Med. Gaz.* xxvi. 67.

[6] Brodie, *Phil. Trans.* 1811, p. 178.

Sir B. Brodie, happening to touch his tongue with a probe which had been dipped in the oil, suffered, almost instantaneously, an indescribable sensation at the pit of the stomach, feebleness of the limbs, and loss of power over the muscles. These effects, however, were quite transient. Several cases of poisoning with it are recorded. The best detailed is that related by Mertzdorff (quoted by Dr. Christison):—"A hypochondriacal gentleman, 48 years old, swallowed two drachms of the essential oil. A few minutes afterwards, his servant, whom he sent for, found him lying in bed, with his features spasmodically contracted, his eyes fixed, staring, and turned upward, and his chest heaving convulsively and hurriedly. A physician, who entered the room twenty minutes after the draught had been taken, found him quite insensible, the pupils immoveable, the breathing stertorous and slow, the pulse feeble, and only thirty in a minute, and the breathing exhaling strongly the odour of bitter almonds. Death ensued ten minutes afterwards." Another case of poisoning with this oil occurred a few years since in Aldersgate Street:—A lady, intending to take beech-nut oil, for worms, swallowed (by mistake) oil of bitter almonds, sold to her by a druggist, who supposed she inquired for peach-nut oil. Recovery has occurred, in one case, after about half an ounce (?) of the oil had been swallowed.[1]

[Various means have been employed to free the oil of bitter almonds of the hydrocyanic acid: thus, Mr. Whipple recommends distilling it from a solution of nitrate of silver, and Mr. Groves adding to the commercial oil the mixed sulphates of iron and liquor potassæ, so as to form Prussian blue, which is separated by filtering off the oil. But Mr. Redwood states, that the hydruret of benzule remaining is more susceptible of oxidation than is the crude oil, and that the oil soon becomes a mere solution of benzoic acid.[2] Mitscherlich[3] has experimented on the effects of this oil on dogs and rabbits; he found it poisonous even when quite free from hydrocyanic acid. He found also, as stated by Wöhler and Frerichs, that it is oxydised in the system when given in small quantity, and is converted into hippuric acid in the urine. In large doses, however, it escapes unchanged into the urine. But Dr. Maclagan finds that dogs were uninjured by doses of ʒij. and ʒiij., and rabbits required at least ʒj. of the oil, when deprived of hydrocyanic acid, to cause death.[4]—Ed.]

In this country, essential oil of bitter almonds is not employed in medicine. It is applicable in the same cases that hydrocyanic acid is employed in. But it must not be forgotten that, though its strength is somewhat variable, it is in general four times the strength of officinal hydrocyanic acid. The dose of it is a quarter of a drop to a drop and a half in an emulsion. It is extensively employed for flavouring by the cook and confectioner; and by the perfumer for scenting toilet-soap, and for other purposes.

Essence of Bitter Almonds; Almond Flavour.—This term is sometimes applied to the essential oil, and sometimes to a solution of the oil in rectified spirit. Two fluidrachms of the oil and six fluidrachms of rectified spirit form a useful essence for flavouring and scenting. [It is a dangerous preparation, as it still holds hydrocyanic acid dissolved. Half an ounce of it has been known to destroy the life of an adult.—ED.]

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[1] *Journ. Chim. Méd.* t. vi. 2de sér. p. 92.
[2] *Pharm. Journ.* xiii. 600.
[3] *Ibid.* vol. x. p. 83.
[4] *Ibid.* xiii. 279.

[5. **AQUA AMYGDALARUM AMARARUM DESTILLATA.** *Pharm. Norvegica. Bitter Almond Water.* Take of Bitter Almonds, six parts; of Water, thirty-six parts; of Rectified Spirit, one part. The bruised almonds are to be completely deprived, by cold pressure, of all the fixed oil. The marc is to be placed with the water in a well-closed retort, and macerated by frequent shaking for a period of twelve hours. Then add the rectified spirit, and distil into a receiver at a gentle heat, until six parts of liquid are obtained. The distilled water is to be kept in a cool and dark place, in a glass bottle blackened on the outside and well secured and stopped. Dose, from 20 to 30 drops. A dose of 60 drops might be attended with danger. The uncertain strength of this preparation in hydrocyanic acid presents a great objection to its use. In England hydrocyanic acid is universally preferred and prescribed.—ED.]

[6. **ACIDUM HYDROCYANICUM.** This acid is a product of the distillation of the marc of the bitter almond with water. The preparation previously described is the only form in which hydrocyanic acid is procured from the vegetable kingdom and applied to medicinal use. Hydrocyanic acid is now almost exclusively prepared in this country from the ferrocyanide of potassium. It is of such importance in medicine that we consider it necessary to give its history and properties in a distinct article.—ED.]

267. ACIDUM HYDROCYANICUM DILUTUM, *L. E. D.*— DILUTED HYDROCYANIC OR PRUSSIC ACID.

(Acidum Hydrocyanicum, *E.*)

HISTORY.—The substance called *Prussian* or *Berlin blue* (*Cæruleum Borussicum* seu *Berolinense*) was accidentally discovered by Diesbach at the commencement of the 18th century, and various conjectures were soon offered regarding its nature. In 1746, Dr. Brown Langrish published some experiments made with laurel water in order to investigate its effects on animals.[1] In 1752, Macquer announced that Prussian blue was a compound of oxide of iron, and some colouring principle which he could not isolate; and in 1772, Guyton Morveau concluded that this principle was of an acid nature. Scheele, in 1782, removed some of the mystery connected with Prussian blue, by obtaining *hydrous prussic acid* from it. In 1787, Berthollet ascertained this acid to be a compound of carbon, nitrogen, and hydrogen. In 1800 and 1802, Bohn and Schrader discovered it in laurel-water. Borda, Brugnatelli, and Rasori, first employed the acid in medicine, from 1801 to 1806. In 1815, Gay-Lussac obtained the acid in its pure *anhydrous* state, and explained its composition.[2]

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[1] *Physical Experiments upon Brutes.* Lond. 1746.

[2] The chemical history of hydrocyanic acid is fully detailed in Thomson's *System of*

SYNONYMES AND ETYMOLOGY.—It has been denominated *Prussic* (*Acidum Borussicum*), *Zootic* (*Acidum Zooticum*), or *Hydrocyanic Acid:* the first name indicates the substance (Prussian blue) from which it was obtained, the second refers to its animal origin, and the third indicates its constituents, hydrogen and cyanogen (so called from *κύανος*, *blue;* and *γεννάω*, *to produce;* because it is one of the constituents of Prussian blue).

NATURAL HISTORY.—Hydrocyanic acid is a product peculiar to the organised kingdom. It may be readily procured from many *vegetables*, more especially those belonging to the suborders *Amygdaleæ* and *Pomeæ:* as from Bitter Almonds, Apple-pips, the Kernels of Peaches, Apricots, Cherries, Plums, and Damsons; the Flowers of the Peach, Cherry-laurel, and Bird-cherry; the Bark of the latter, and the Root of the Mountain Ash. It is said to have been also obtained from plants of other families, as from *Rhamnus Frangula* and Ergot of Rye. In some of the vegetables now referred to, hydrocyanic acid does not exist ready formed, but is a product of the process by which it is obtained. This has been fully proved in the case of the bitter almond, and is inferred in other instances.

This acid is rarely, if ever, found in animals. One of its constituents (cyanogen) has, however, been detected, in combination with iron (forming Prussian blue), in the urine, the menstrual fluid, and the sweat: and with sulphur and potassium in the saliva. The greenish-blue discharge of some ulcers probably depends on the presence of Prussian blue. In one case I detected the presence of iron in this discharge.[1] During the decomposition of animal matters by heat, cyanogen is generated: as when blood and carbonate of potash are calcined in an iron pot. It has also been stated that, when cheese is exposed to the action of water and the sun, it disengages ammonia, and if treated, in this state, by alcohol, yields traces of hydrocyanic acid.

PREPARATION.—The processes for procuring this acid are very numerous. I shall only notice the most important of those which yield the dilute acid employed for medicinal purposes.

α. By the action of diluted Sulphuric Acid on Ferrocyanide of Potassium.—This is the process directed by the London, Edinburgh, and Dublin Colleges:—

The *London College* orders of "Ferrocyanide of Potassium, ℥ij.; Sulphuric Acid, ʒvij.; Distilled Water, Oiss. Mix the acid with four fluidounces of the water, and to these, when cooled and put into a glass retort, add the ferrocyanide of potassium, first dissolved in half a pint of water. Pour eight fluidounces of the water into a cooled receiver; then, having adapted the retort, let six fluid ounces of acid, distilled with a gentle heat in a sand bath, pass into this water. Lastly, add six more fluidounces of distilled water, or as much as may be sufficient, that 12·59 grains of nitrate of silver, dissolved in distilled water, may be accurately saturated by 100 grains of this acid." The resulting product should be twenty ounces.

Inorganic Chemistry, vol. ii. 7th edition. The medical history of it is contained in Dr. Granville's *Hist. and Pract. Treatise* on this acid, 2d ed. 1820.

[1] Is the formation of cyanogen dependent on the oxidation of gelatine? Persoy states, that when gelatine is submitted to an oxidising agent it is susceptible of being transformed into hydrocyanic acid, ammonia, and carbonic acid, and a small quantity of one of the fat, volatile, and odoriferous acids, the existence of which was established by Chevreul (*Brit. and For. Med. Rev.* vol. xii. p. 532).

The *Edinburgh College* orders of "Ferrocyanide of Potassium, ℥iij.; Sulphuric Acid, f℥vj.; Water, f℥xvj. Dissolve the salt in eleven fluidounces of the water, and put the solution into a matrass; add the acid, previously diluted with five fluidounces of the water, and allowed to cool: connect the matrass with a proper refrigeratory; distil with a gentle heat, by means of a sand-bath or naked gas flame, till fourteen fluidounces pass over, or till the residuum begins to froth up. Dilute the product with distilled water till it measures sixteen fluidounces."

[The *Dublin College* directs of "Ferrocyanide of Potassium, ℥ij.; Oil of Vitriol of commerce, f℥j.; and Water, f℥xij. Dissolve the salt in eight ounces of the water, and dilute the oil of vitriol with the remaining four ounces. When both solutions are cold introduce them successively into a retort or matrass containing several slips of platinum foil, and connected in the usual manner with a Liebig's condenser; and with the aid of a little gentle heat let eight ounces be distilled over. Finally, dilute the product with eight ounces of distilled water, or so that the volume of the diluted acid shall be sixteen fluid ounces. The specific gravity of this acid is ·997.

The U. S. Pharmacopœia directs "Ferrocyanide of Potassium, ℥ij.; Sulphuric Acid, ℥iss.; Distilled Water, a sufficient quantity. Mix the acid with four fluidounces of distilled water, and pour the mixture, when cool, into a glass retort. To this add the ferrocyanide of potassium, previously dissolved in ten fluidounces of distilled water. Pour eight fluidounces of distilled water into a coated receiver; and having attached this to the retort, distil, by means of a sand-bath with a moderate heat, six fluidounces. Lastly, add to the product five fluidounces of distilled water, or as much as may be sufficient to render the diluted hydrocyanic acid of such a strength that 12·7 grains of nitrate of silver dissolved in distilled water may be accurately saturated by 100 grains of the acid."

Diluted hydrocyanic acid may also be prepared, when wanted for immediate use, in the following manner. Take Cyanide of Silver, fifty grains and a half; hydrochloric Acid, forty-one grains; Distilled Water, a fluidounce. Mix the hydrochloric acid with the distilled water: add the cyanide of silver, and shake the whole in a well-stopped phial. When the insoluble matter has subsided, pour off the clear liquor and keep it for use.

The proportionate strength of the United States Prussic acid is similar to that of the English Pharmacopœia,—namely, about two per cent. of anhydrous acid.—ED.]

On a large scale, the distillation is conducted in a stoneware still, with a worm refrigerator of the same material. If it be performed in a [tubulated] retort, as directed in the London Pharmacopœia, an adopter should be employed. When small quantities are to be operated on, we may conveniently employ two Florence flasks (one as the receiver, the other as the distilling vessel), connected by a glass tube curved twice at right angles. The receiver should be kept very cool, ice or snow being used if it can be procured; and the heat employed in distilling should be very moderate. The distilled liquor frequently contains a little sulphuric acid, and, by standing, deposits a small portion of Prussian blue. A second distillation, cautiously conducted, will often separate the sulphuric acid; but I have seen Prussian blue formed and deposited after the hydrocyanic acid has been carefully distilled three times.

The theory of the process, founded on the experiments of the late Mr. Everitt[1], is as follows:—Six equivalents or 294 parts of oil of vitriol ($SO^3+Aq.$) react on two equivalents or 426 parts of crystallised ferrocyanide of potassium (composed of four equivalents of cyanide of potassium, two of cyanide of iron, and six of water), and produce three equivalents or 384 parts of the bisulphate of potash, three equivalents or 81 parts of hydrocyanic acid, one equivalent or 174 parts of a new salt (which I shall term the *biferrocyanide of potassium*), and nine equivalents or 81 parts of water. The bisulphate and the new salt remain in the retort, while the hydrocyanic acid with some water distils over. In the London Pharmacopœia an additional quantity of water is employed to assist the condensation of the acid.

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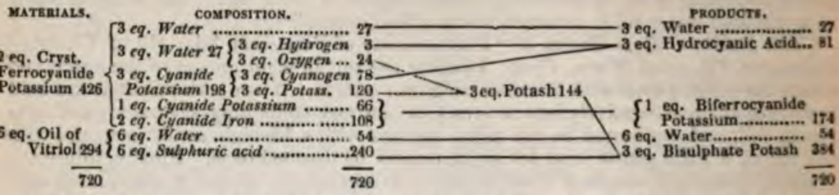
[1] *Lond. and Edinb. Phil. Mag.* Feb. 1835.

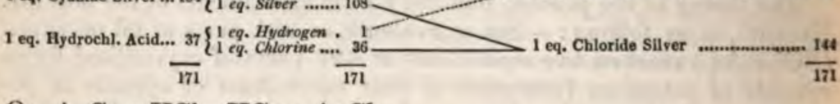


The salt here called biferrocyanide of potassium is termed, by the late Mr. Everitt, the *yellow salt.* I have prepared it with the greatest care, but have always found it to be white. Gay-Lussac also says it is white.[1] By exposure to the air it becomes blue.

[Wittsteim, however, considers that in the preparation of hydrocyanic acid from ferrocyanide of potassium and sulphuric acid, the first action consists in the formation of sulphate of potash and hydroferrocyanic acid, while one-fourth of the ferrocyanide remains unaltered $4\ (2\,HCy+FeCy)\ \&\ 6(SO_3HO)=6HOSO_3,\ \&\ 3FeCy+2HCy\ \&\ 2HCy+FeCy$. The hydroferrocyanic acid is decomposed by heat into hydrocyanic acid and cyanide of iron, which combines with the unaltered ferrocyanide of potassium, forming the insoluble compound $HCy+2\,FeCy\ 3\ (FeCy+2HCy)\ \&\ 2(HCy+FeCy)=6HCy\ \&\ 2HCy+9FeCy$. [The insoluble substance undergoes further metamorphoses, resulting in the formation of basic Prussian blue.—ED.]

β. By the action of Hydrochloric Acid on Cyanide of Silver.—This process, proposed by Mr. Everitt, yields an acid of uniform strength, and may be followed when the acid is required for immediate use. The proportions directed by Mr. Everitt are 40 grains of cyanide, 7 fluidrachms and 20 minims of water, and 40 minims of dilute hydrochloric acid (sp. gr. 1·129). This gentleman says, that practitioners could obtain an ounce of the acid, prepared by this process, for one shilling, while the manufacturer could obtain 50 per cent. profit by it.

The *theory* of the process is as follows:—By the mutual reaction of one equivalent or 134 parts of cyanide of silver and one equivalent or 37 parts of hydrochloric acid, there are obtained one equivalent or 144 parts of chloride of silver, and one equivalent or 27 parts of hydrocyanic acid.



Or, $AgCy+HCl=HCy+AgCl$.

γ. By the action of Hydrochloric Acid on Bicyanide of Mercury.—At Apothecaries' Hall hydrocyanic acid was formerly prepared from one part of bicyanide of mercury, one part hydrochloric acid (sp. gr. 1·15), and six parts of water. The mixture was distilled until six parts had passed over. The acid thus obtained had a sp. gr. 0·995, and its standard strength was such, that two fluidrachms of it dissolved 14 grains of the red oxide of mercury, thereby indicating a strength of about 2·9 per cent. of real acid.

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[1] *Ann. Chim. et Phys.* t. xlvi. p. 77.

[2] *Vierteljahrschrift für Pract. Pharmacie,* iv. 515.

[3] *Pharm. Journ.* xv. 429.

The most convenient method of procuring *concentrated* or *anhydrous* hydrocyanic acid is by the action of strong liquid hydrochloric acid on bicyanide of mercury. The vapour should be passed over carbonate of lime, to deprive it of hydrochloric acid; and over chloride of calcium, to remove the water. The receiver should be immersed in a freezing mixture, consisting of ice and chloride of sodium. The theory of the process is as follows:—Two equivalents or 74 parts of hydrochloric acid react on one equivalent or 254 parts of the bicyanide of mercury, and form one equivalent or 274 parts of the bichloride of mercury, which remain in the retort, and two equivalents or 54 parts of hydrocyanic acid, which distil over ($HCl + HgCy = HCy + HgCl$).

δ. *By the action of Tartaric Acid on Cyanide of Potassium.*—This process was proposed by Dr. Clarke, and adopted by Mr. Laming. The formula of the latter is the following:—22 grains of the cyanide of potassium are to be dissolved in 6 fluidrachms of distilled water, and to this solution are to be added 50 grains of crystallised tartaric acid, dissolved in 3 fluidrachms of rectified spirit. One fluidrachm of the decanted liquor contains one grain of pure hydrocyanic acid.

The objections to this process (which, however, has several advantages) are the trouble and expense of procuring pure cyanide of potassium, and the liability of the salt to undergo spontaneous decomposition.

PROPERTIES.—*a. Of Anhydrous Hydrocyanic Acid.*—[The acid may be obtained anhydrous by passing a current of dry sulphuretted hydrogen gas over finely powdered cyanide of mercury contained in a glass tube. The vapour of the acid should be condensed by conducting it into a Liebig's condenser charged with ice-cold water. The decomposition is represented by the following equation, $HgCy + HS = HCy + HgS$.—ED.] Anhydrous hydrocyanic acid is a solid at 0° F. (some state at 5° F.), having then the appearance of crystallised nitrate of ammonia; it readily melts, forming a limpid colourless liquid, with an intense and peculiar odour; its taste is at first cool, then hot; at 45° its sp. gr. is 0·758, and at 64½ it is 0·6969. In this state it is exceedingly volatile: a drop placed on paper freezes by its own evaporation. It unites with water and alcohol in every proportion. At 79° or 80° F. it boils, forming hydrocyanic acid vapour, which is combustible; and when mixed with oxygen and ignited, it explodes. Two volumes of the vapour require two and a half volumes of oxygen gas for their complete combustion. The products are two volumes of carbonic acid gas, one volume of nitrogen, and one volume of aqueous vapour, $HCy + O^5 = HO + N + 2CO^2$.

Anhydrous hydrocyanic acid undergoes speedy decomposition.[1] Dr.

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[1] [The change which ensues under the influence of light appears to be the formation of a brownish black substance (not examined) and sesquicarbonate of ammonia. A small quantity of a mineral acid, diluted, is well known to prevent the change; but a concentrated mineral acid rapidly converts hydrocyanic acid into ammonia and formic acid, if the elements of water be present: $HCy + 3HO = NH^3 + C^2H,O^3$.—ED.]

Christison says he has kept it unchanged for a fortnight in ice-cold water. When diluted with water, or mixed with a diluted mineral acid, its tendency to decomposition is diminished.

β. Of Diluted Hydrocyanic Acid.—Diluted or medicinal hydrocyanic acid is a colourless, transparent liquid, having the taste and smell of the strong acid, but in a lesser degree. Heated in a tube it gives off a combustible vapour.

COMPOSITION.—The ultimate constituents of pure hydrocyanic acid are Carbon, Nitrogen, and Hydrogen.

	Atoms.	*Eq. Wt.*	*Theory.*	*Gay-Lussac.*		*Vols.*
Carbon	2	12	44·4	44·45	Carbon vapour	1 or 2
Nitrogen	1	14	51·9	51·85	Nitrogen gas	1
Hydrogen	1	1	3·7	3·70	Hydrogen gas	1
Hydrocyanic Acid	1	27	100·0	100·00	Hydrocyanic Vapour	2

But it is more usual to regard this acid as a compound of hydrogen and cyanogen, the latter substance being a bicarburet of nitrogen. On this view the composition will be as follows:—C^2N,H or CyH.

	Atoms.	*Eq. Wt.*	*Per Cent.*		*Vols.*
Cyanogen	1	26	96·3	Cyanogen gas	1
Hydrogen	1	1	3·7	Hydrogen gas	1
Hydrocyanic Acid	1	27	100·0	Hydrocyanic Vapour	2

STRENGTH OF THE DILUTED ACID.—In the London Pharmacopœia, hydrocyanic acid is directed to be prepared of such a strength that 100 grains of it will exactly precipitate 12·59 grains of nitrate of silver dissolved in water:—the precipitate, which is cyanide of silver, should weigh when quite dry 10 grains. Five parts of this precipitate correspond to one of real acid. Hence the diluted acid *Ph. L.* consists of—

Real hydrocyanic acid	2·0
Water	98·0
Diluted Hydrocyanic Acid (Ph. L.)	100·0

The Acidum Hydrocyanicum *Ph. Ed.* consists of "Hydrocyanic Acid diluted with about thirty parts of water." Hence its per-centage composition is as follows:—

Real hydrocyanic acid	3·226
Water	96·774
Acidum Hydrocyanicum (Ph. Ed.)	100·000

[This preparation has nearly twice the strength of the London acid. According to Mr. Squire, 100 minims, or 91 grains, should entirely precipitate 22 grains of nitrate of silver: it has therefore nearly a strength of 3·98 per cent. Dr. Christison assigns 3·3 per cent. as its ordinary strength.—ED.]

The Edinburgh College gives the following directions for ascertaining the strength of the acid:—

"Fifty minims [of the acid] diluted with one fluidounce of distilled water, agitated with 390 minims of solution of Nitrate of Silver [*Ph. Ed.*], and allowed to settle, will again give a precipitate with 40 minims more of the test; but a further addition of the test, after agitation and rest, has no effect. The precipitate entirely disappears in boiling nitric acid."

[The Acidum Hydrocyanicum Dilutum *Ph. Dub.*, as now made, contains, according to Mr. Squire, rather more than 2 per cent. of real acid.[1] The strength of the acid has not been fixed by this College.—ED.]

This discrepancy in the strength of the acid ordered in the British pharmacopœias is greatly to be regretted. Most of the acid met with in the shops of London chemists is stated by the label to be of "Scheele's strength." But as Scheele's process[2] gave an acid of variable strength, this statement is by no means definite. A manufacturer of large quantities of the acid informs me he sells, under the name of Scheele's acid, a diluted hydrocyanic acid, which contains 4 per cent. real acid.

PURITY.—Diluted hydrocyanic acid should be perfectly colourless. Decomposed acid is frequently, but not invariably, coloured. It should be vaporisable by heat: this character shows the absence of fixed impurities. The presence of metallic matter is recognised by hydrosulphuric acid, which has no effect on the pure acid. If the acid strongly redden litmus, it must contain some other acid, most probably the sulphuric or hydrochloric. The presence of any foreign acid is easily determined by the *hydrargyro-iodocyanide of potassium*. This salt is formed by adding a concentrated solution of bicyanide of mercury to a solution of iodide of potassium; a precipitate of white or pearly crystalline plates of the salt is immediately produced. If a small portion of the crystals be placed in diluted hydrocyanic acid, no change is observed unless some foreign acid be present: in the latter event the red biniodide of mercury immediately makes its appearance. For this test we are indebted to Dr. Geoghegan.[3] Sulphuric acid may be detected by a solution of the salts of barium. "Solution of nitrate of baryta occasions no precipitate" in the pure acid (*Ph. Ed.*); but if sulphuric acid be present, it occasions a white precipitate (*sulphate of baryta*), insoluble in nitric acid. Hydrochloric acid is recognised by nitrate of silver, which forms therewith white chloride of silver insoluble in boiling nitric acid, whereas the white cyanide of silver is soluble in nitric acid at a boiling temperature. I would observe, that the presence of either of these acids is no further objectionable than that it creates a difficulty in the determination of the strength of the hydrocyanic acid: while on the other hand, it confers the advantage of rendering the hydrocyanic acid much less liable to decomposition. The acid prepared from ferrocyanide of potassium will keep for years (Dr. Christison has had some unchanged for two years and a half, though it was exposed to daylight), owing, it is supposed, to the presence of some sulphuric acid. Mr. Barry adds a little hydrochloric acid to all his medicinal hydrocyanic acid, in order to preserve it. As air and light hasten, though they are not essential to, the decomposition of the acid, they should be carefully excluded.

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[1] *Dublin Pharmacopœia*, 1850.

[2] Scheele prepared this acid by boiling together Prussian blue, peroxide of mercury, and water. Bicyanide of mercury was obtained in solution. Iron filings and sulphuric acid were then added, and the products of the reaction were hydrocyanic acid, metallic mercury, and sulphate of iron. The liquor was then submitted to distillation.—The strength of the acid product varied with the degree of purity of the Prussian blue.

[3] *Dublin Journal*, Nov. 1835.

Characteristics.—The following are the best tests for hydrocyanic acid:—

1. *The odour.*—The peculiar odour of hydrocyanic acid is well known. It must not be confounded with the odour of the volatile oil of bitter almonds. Orfila says, that this is the most delicate characteristic of the acid, since it is very marked when the liquid tests give very slight indications only. But I have not found this to be invariably the case: it depends much on the nature of the mixture containing the acid.

2. *Formation of Prussian blue* (*Ferrosesquicyanide of iron*).—Add sufficient caustic potash to the suspected acid to saturate it; then a solution of some proto- and sesqui-salt of iron; the common sulphate of iron of the shops, or the tincture of the chloride, answers very well, since both these preparations usually contain the two (*proto-* and *sesqui-*) salts of iron. A precipitate is thus obtained, which is liable to considerable variation in its colour, depending on the quantity of potash or of the ferruginous salt employed; it may be yellowish brown, or greenish, or bluish. Then add dilute sulphuric or hydrochloric acid, when Prussian blue (ferrosesquicyanide of iron) will immediately make its appearance, if hydrocyanic acid were present.

The formation of Prussian blue is thus accounted for. When potash is added to hydrocyanic acid, water and cyanide of potassium are generated. By the reaction of this salt on a proto-salt of iron the proto-cyanide of iron is produced, while with a sesqui-salt of iron it forms sesquicyanide of iron. The two ferruginous cyanides, by their union, constitute the ferrosesquicyanide or Prussian blue. The acid added removes the surplus oxide of iron.

[This test will detect hydrocyanic acid when it is mixed with common salt or other chlorides which interfere with the reaction of nitrate of silver. It is on the whole a delicate test when properly employed; but a frequent cause of failure in its application is the addition of too much potash, or of the iron salt. The Prussian blue formed is decomposed by an excess of potash; and if the quantity of iron be too large, the liquid, when the surplus oxide of iron is dissolved by an acid, will acquire a yellow colour, and give a greenish tint to the small quantity of Prussian blue formed at the expense of the hydrocyanic acid. This experiment may be performed in a white saucer. Put a drop of solution of potash in the centre of the saucer, and invert it over another saucer of the same size containing the hydrocyanic acid. After two or three minutes (or five minutes if the acid be much diluted), remove the upper saucer, and drop on the potash one drop of a solution of green sulphate of iron. Agitate and expose to the air for a few seconds. Add one or two drops of diluted sulphuric acid to dissolve the surplus oxide of iron, and if prussic acid was present, a slight trace of Prussian blue will remain in the liquid.—Ed.]

3. *Nitrate of Silver.*—This is a delicate test of the presence of hydrocyanic acid. It causes a white precipitate of cyanide of silver, which is soluble in *boiling* concentrated nitric acid. By this latter character

cyanide is distinguished from chloride of silver. If carefully dried cyanide of silver be heated in a small glass tube, it evolves cyanogen gas, known by its combustibility and the colour (violet or bluish red) of its flame.

[A watch-glass moistened with nitrate of silver, and inverted over a vessel containing hydrocyanic acid, will enable us to detect the presence of a very minute quantity of the acid. The spot of nitrate of silver becomes speedily opaque and white, from the production of cyanide by the action of the vapour of the acid.

4. *The Sulphur Test.*—A few years since Liebig made the discovery that a mixture of hydrocyanic acid and hydrosulphate of ammonia, when warmed, underwent decomposition, and sulphocyanate of ammonia resulted. The application of a per-salt of iron, by producing a deep blood-red colour in a liquid containing even a minute trace of sulphocyanate, thus enables us to detect the presence of prussic acid indirectly.

When hydrocyanic acid is procured in a free state as a liquid, the Prussian blue and silver tests are sufficient to determine its presence unequivocally; but when the acid is in small quantity, and mixed with solids or fluids partially decomposed, then a modification of this test will enable us to detect a quantity of the poison which, from its minuteness, and from the absence of the usual odour, might otherwise escape notice.

Place the solid or liquid, suspected to contain the poison, in a glass vessel, to the top of which a large watch-glass can be pretty accurately adjusted. The poisoned liquid or solid should fill the glass vessel to within half an inch of the top. If the quantity be small, then another watch-glass, of equal size to that taken, may be employed.

Place two drops of a solution of hydrosulphate of ammonia, containing an excess of sulphur, in the centre of the upper glass, and inverted accurately over the vessel containing the poisoned liquid. In three or four minutes the upper glass may be removed, and the moistened spot gently dried over a spirit lamp or in a sand-bath. A white film is left when the quantity of acid is small: this may be a film of sulphur resulting from the evaporation of the hydrosulphate of ammonia, or a film of sulphocyanate of ammonia formed by a reaction of the vapour of hydrocyanic acid on the hydrosulphate. In the latter case the film has frequently a crystalline character. The film may be moistened with a drop of water, and a drop of per-sulphate or per-chloride of iron allowed to fall on it. If prussic acid was present in the suspected solid or liquid, a blood-red coloured liquid appears (sulphocyanate of iron), and this red colour is discharged by the addition of one or two drops of a solution of corrosive sublimate.

If there were no prussic acid present, the film will be sulphur, and the solution of per-salt of iron will produce no effect. If any undecomposed hydrosulphate remain on the glass (a fact generally known by the liquid having a yellow colour), then the per-salt of iron will produce a black precipitate (sulphuret of iron). In this case the evaporation has not been carried far enough.

Except in liquids or solids which have undergone decomposition, and from which sulphuretted hydrogen is evolved, the nitrate of silver, applied as already described (pp. 262, 263.), to receive and absorb the vapour, may be usefully employed as a preliminary or trial test.

[The sulphur test, as applied to the vapour of hydrocyanic acid, is the most delicate test for this poison which has been hitherto discovered.—ED.]

DETECTION OF THE ACID IN CASES OF POISONING.—As hydrocyanic acid is a substance which readily undergoes decomposition, it is not likely to be met with in bodies which have been interred for many days. It has, however, been recognised in one case, seven days after death, notwithstanding that the trunk had not been buried, but had been lying in a drain;[1] and in other cases for still longer periods. In recent cases the acid is readily distinguished by its odour, with which, in some instances, the whole body is impregnated. The liquid tests for this acid, already mentioned, will sometimes detect the poison in the filtered contents of the stomach; but the foreign matters present may occasionally prevent their characteristic action. The best mode of proceeding in that case, is, to introduce them into a tubulated retort, to add some sulphuric acid to neutralise any ammonia that might be generated by the process of putrefaction, and to distil to one-half by means of a vapour or water-bath: then apply the tests already mentioned to the distilled liquid. The addition of sulphuric acid is not necessary unless the liquid be strongly alkaline.

It has been suggested, that hydrocyanic acid may be formed during the process of distillation by the decomposition of animal matters; but, as Dr. Christison has justly observed, the objection appears only to rest on conjecture, or presumption at farthest. [Further, the objection is untenable when the poison can be detected by its vapour prior to distillation.—ED.] It is to be recollected, that unsound cheese has, under certain circumstances, been found to contain this acid, as already mentioned. It is not improbable that it may be found in many animal substances during their spontaneous decomposition. It is said to have been detected in ergot of rye.

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—Hydrocyanic acid is a poison to plants. The stamina of *Berberis vulgaris* and the leaves of *Mimosa pudica* lose their irritability when the stems bearing them are immersed in the diluted acid.[2] Seeds lose the power of germination by immersion in this acid. In those parts of lactescent plants which are poisoned by it, the milky juice does not flow from the cells or vessels in which it is contained. By chemical means it has been shown that the acid becomes absorbed.[3] Ammonia has, in some cases, appeared to favour the recovery of plants which had been exposed to the vapour of the acid.[4]

β. On Animals generally.—Hydrocyanic acid is an energetic poison to animals. Experiments have been made with it on the following:—*Mammalia, Aves, Reptilia, Amphibia, Pisces, Gasteropoda, Annelida, Crustacea, Insecta,* and *Infusoria.*[5] The general effects are very similar on all classes, and consist essentially of loss of sensation and voluntary motion, with convulsive movements. Mr. Gray, however, states that some of the larvæ of the common Musca having been put into hydrocyanic acid, remained uninjured after two or three days' exposure.[1] The cold-blooded animals are more slowly affected by hydrocyanic acid than the hot-blooded ones. Dr. Christison states that 25 grs. of the strong acid, applied to the mouth, killed a rabbit within ten seconds. I once caused the almost instantaneous death of a rabbit by applying its nose to a receiver filled with the vapour of the pure acid: the animal died without the least struggle. If a drop of the pure acid be placed on the throat of a dog, or applied to the eye, death takes place in a few seconds. Inhaling the vapour decidedly produces death more quickly than any other mode of using the acid. If the pure acid be applied to the eye of a dog, it causes opacity and whiteness of the cornea, and a copious flow of tears. In a very short time it gives rise to constitutional symptoms.

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[1] Chevallier, *Ann. d'Hygiène Publiq.* ix. 337.

[2] Macaire, *Biblioth. Universelle,* xxxi. 244.

[3] De Candolle, *Physiol. Végét.* p. 1357.

[4] Macaire, *op. cit.*

[5] Coullon, quoted by Wibmer, *Wirkung d. Arzneim.* 3 Bd. p. 110.

γ. *On Man.* αα. *In small or medicinal doses.*—Small doses of hydrocyanic acid sometimes relieve certain morbid conditions (as of the stomach), without producing any remarkable alteration in the condition of the general system. If the dose be cautiously increased, and its operation carefully watched, the following effects are usually observed:—a bitter but peculiar taste; increased secretion of saliva; irritation in the throat; frequently nausea; disordered and laborious respiration (sometimes quick, at others slow and deep); pain in the head, giddiness, obscured vision, and sleepiness. The vascular system is in some cases not obviously, but in others much, affected, though not uniformly; its action being sometimes quickened, at others reduced in frequency. In some instances faintness is experienced. Drs. Macleod and Granville[2] have noticed salivation and ulceration of the mouth during its medicinal use.

ββ. *In poisonous doses: convulsions and insensibility* (epilepsy?): *if death occur, it takes place slowly.*—Immediately after swallowing the acid, a remarkably bitter taste, sometimes described as hot, is experienced; this is soon followed by a sensation of faintness and giddiness, with salivation, and is succeeded by tetanic convulsions and insensibility; the respiration is difficult and spasmodic; the odour of hydrocyanic acid may be recognised in the breath; the pupils are usually dilated, though sometimes contracted; the pulse is small or imperceptible. When recovery takes place it is usually very rapid, and the whole period of suffering seldom exceeds half an hour. However, exceptions to this exist, in which the symptoms have been prolonged for several hours.

The following case, related by Dr. Geoghegan[3], is an interesting illustration of these effects:—A gentleman, aged 21, having been for some time subject to an uneasiness in the stomach, not actually amounting to gastrodynia, after having tried many remedies in vain, was induced to have recourse to hydrocyanic acid. He commenced with one minim of the Dublin Pharmacopœia, sp. gr. 0·998: this dose he repeated twelve times the first day, without any perceptible effect. On the following day, he took half a drachm, with the same result. The third day his dose was a drachm, which he repeated the fourth day. On the fifth day he took a drachm and a half; still no effect of any kind. On the sixth day he increased his dose to two drachms. In about two minutes after taking this quantity, he experienced a sensation of extreme bitterness in the mouth, and having walked a few paces, was affected with great confusion, headache, and loud ringing in his ears. He now with difficulty retraced his steps, and leaning forward on a table, became insensible and fell backwards. In this state he remained altogether between three and four minutes, during which time he was violently convulsed. Two drachms of the spiritus ammoniæ aromaticus were diluted with a little water, and applied as quickly as possible to the mouth, but as the teeth were clenched, it could not be swallowed. The solid sesqui-carbonate of ammonia was then applied assiduously to the nostrils; its beneficial effects were soon apparent, and he was shortly able to swallow a little fluid. Sensibility now speedily returned, and vomiting supervened, from which he experienced great relief; and at the expiration of half an hour he was quite well, with the exception of pain and a feeling of distension in the head, which continued for the remainder of the day. After he had become insensible, and while leaning on the table, his thighs became rigid, and were drawn up on the abdomen; and as he was about falling, he was caught and placed on the ground. The upper extremities were then observed to be also rigid, and on drawing them from the side they forcibly reverted to their former position; the eyes were shut, the teeth clenched, and the muscles of the face violently convulsed. It is deserving of notice that the old complaint was completely removed by this extraordinary dose.

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[1] *Athenæum* for 1837, p. 671.

[2] *Lond. Med. and Phys. Journ.* vol. xlvi. pp. 359 and 363.

[3] *Dublin Med. Journ.* Nov. 1835.

γγ. In poisonous doses: death rapid with or without convulsions.— In these cases death is so rapid that, in the human subject, the symptoms have scarcely been observed. They are probably similar to those noticed in animals,—viz. imperceptible pulse, breathing not obvious; or there may be two or three deep, hurried inspirations, insensibility, and death. Convulsions may or may not be present.

The presence or absence of convulsions, as connected with the time within which death occurs in these cases, is sometimes a matter of great moment. Some years ago the life of a prisoner almost turned on this point. The following is an outline of the case:[1]—An apothecary's maid servant, at Leicester, was found one morning dead in bed. The body lay in a composed posture—the arms crossed over the trunk, and the bed-clothes pulled smoothly up to the chin. At her right side lay a phial, from which about five drachms of the medicinal hydrocyanic acid had been taken, and which was corked and wrapped in paper. It was suspected that she took the acid to occasion miscarriage, and that the apprentice was accessory to its administration; in consequence of which he was put on his trial. The important question for the consideration of the medical witnesses was,—Could the deceased, after having drunk the poison, have had time to cork the phial, wrap it up, and adjust the bed-clothes, before insensibility came on? It was supposed that if the death were of that slow description to allow of these acts of volition, convulsions would have occurred, and the bed-clothes would have been found disordered. On the other hand, those cases in which no convulsions occur usually terminate too quickly to allow of the above acts. The medical witnesses in the above case were not agreed in opinion: the majority thought it was impossible that the deceased could have had the power of corking the bottle. The jury, however, very properly found the prisoner not guilty.

There are two points of inquiry connected with the action of this acid, which are interesting, more particularly in a medico-legal point of view—namely, the time at which the poison begins to operate, and the period in which it proves fatal. No absolute answer can be given to either of these questions, since the strength and quantity of the acid exhibited, and peculiarities (not known or understood) affect the result. Very strong acid, in large doses, begins to operate very speedily, especially if its vapour be inhaled. The diluted acid, on the other hand, sometimes does not produce any obvious effect for several minutes, and death may not occur for nearly half an hour. Of seven epileptic patients killed in one of the Parisian hospitals by hydrocyanic acid, some did not die for forty-five minutes.[1] But I have not found the same quantity of the same acid kill different animals of the same species in the same period of time.

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[1] More fully developed in Dr. Christison's *Treatise on Poisons*, and in the *Medical Gazette*, vol. viii. pp. 577 and 797.

MORBID APPEARANCES.—The post-mortem appearances in cases of poisoning by this acid are the following:—Glistening and staring expression of the eyes, but which, however, is not a constant phenomenon, since it was not observed in the seven Parisian epileptics: nor is it peculiar to this poison, for the same is observed after death by carbonic acid, and in other cases (Christison): the odour of the acid is oftentimes very obvious in the blood, brain, chest, or stomach: the venous system is usually gorged with blood, while the arteries are empty: the blood is, in many cases, fluid, dark, or bluish-black, and viscid or oily: the vessels of the brain and spinal marrow are frequently gorged with blood; and the cerebral ventricles sometimes contain a serous or sanguineous liquor: the lungs are, in some instances, natural—in others, turgid with blood: the internal lining of the stomach is sometimes red. It has been stated by Magendie, that, after death by the strong acid, the muscles are not sensible to the galvanic influence. But this condition is very rarely present; indeed I have never observed it in animals killed by this acid; though Dr. Christison has occasionally found it. I have examined a considerable number of animals (principally rabbits) destroyed by hydrocyanic acid, and have always found the muscles to be powerfully affected by the galvanic influence: nor have I once met with a single case in which the heart had ceased to beat when the chest had been laid open immediately after death.

MODUS OPERANDI.—There are several interesting subjects of inquiry connected with the operation of hydrocyanic acid, which, as they are principally theoretical, I shall briefly notice under this head.

α. *Local action.*—Dr. Christison says that Robiquet's fingers became affected with numbness, which lasted several days, in consequence of their exposure for some time to the vapour of this acid.[2] This effect would appear to depend on the local action of the poison on the nerves,—a mode of operation which we are constrained likewise to admit in the case of some other narcotics.[3] The alleviation of gastrodynia by hydrocyanic acid depends probably on this benumbing effect. Some of the local effects produced by hydrocyanic acid are those of an irritant: such are, the acrid impression made by the vapour on the nose and mouth, the ptyalism, the vomiting and purging, and the redness of the mucous membrane of the stomach.

β. *Absorption.*—That hydrocyanic acid becomes absorbed is proved by its having been detected by Krimer (quoted by Dr. Christison, p. 15), in the blood of animals poisoned with it, and by the odour of it exhaled from various parts of the body. The exhalation by the breath of the odour of the acid may sometimes enable us to recognise the presence of the poison in the system.[1]

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[1] *Annales d'Hygiène Publ. et de Méd. Lég.* t. ii.

[2] *Treatise on Poisons*, 3d edit. p. 698.

[3] Müller's *Physiology*, by Baly, vol. i. p. 630.

γ. *Are the remote effects of this acid caused by its absorption?*—In many cases the operation of hydrocyanic acid on the system is so rapid, and death so speedily follows the application of the poison, that doubt has been entertained of its action being dependent on its absorption. The principal arguments which have been adduced in favour of the agency of absorption are the following:—*First*, that the acid produces no remote effects when applied either to the nerves or brain: *secondly*, that applied to the tongue or stomach it operates as an energetic poison, although the nerves of these parts were previously divided: *thirdly*, that if the acid be applied to a part where circulation is arrested, the operation of the poison is prevented: *fourthly*, the activity of the acid is in proportion to the absorbing powers of the part with which it is placed in contact: *fifthly*, a sufficient time always elapses between its application to the body and the first symptom of its action, to admit of its operation by absorption.

δ. *Organs affected.*—The parts specifically affected by this acid are the brain and true spinal system. The pain in the head, the insensibility, and the coma, are evidence of the cerebral affection; while the tetanic convulsions depend on the disorder of the true spinal system. Marx[2] mentions the following experiment performed by Wedemeyer,[3] and which shows the independent action of the acid on the spinal marrow:—The spinal cord of a dog was divided between the last dorsal and first lumbar vertebræ, so that the hind legs were completely paralysed and insensible to mechanical irritants: hydrocyanic acid was then introduced into one of the hind legs;—in one minute symptoms of poisoning commenced; the hind as well as the fore legs were violently convulsed, and in twelve minutes the animal was dead. The affection of the respiratory and circulatory system produced by hydrocyanic acid is probably only secondary: that is, the result of the influence of this agent over those parts of the nervous system from which the respiratory organs and heart derive their nervous power. The insensibility caused by hydrocyanic acid occurs too rapidly, in many cases, to be the result of asphyxia caused by paralysis of the muscles of respiration.

ε. *Condition of the brain and spinal marrow induced by this acid.*—The precise pathological condition of the brain and spinal cord of an animal under the influence of hydrocyanic acid, cannot be positively determined, and it is, therefore, a matter of conjecture. Whatever it may be, it is probably identical with that which occurs during an epileptic paroxysm, and with that produced by loss of blood: for the essential symptoms (insensibility and convulsion occurring suddenly) are the same in all three states,—and ammonia has been found to relieve them. Dr. Marshall Hall[4] has shown that the convulsions from hæmorrhage are spinal. Dr. Holst, Professor of Materia Medica in the

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[1] Dr. Lonsdale, in the *Edinb. Med. and Surg. Journ.* for Jan. 1839.

[2] *Die Lehre von d. Giften*, 1er Bd. 2te Abt. S. 154.

[3] *Versuche über das Nervensystem*, S. 241, Vers. 7.

[4] *Lect. on the Nerv. Syst.* p. 139.

University of Christiania, Norway, informed me of a case of epilepsy which had been under his care, and in which it was observed that the pulse in one arm was always imperceptible during the paroxysm. On a post-mortem examination it was discovered that an anomalous distribution of the arteries existed, so that this arm was supplied with blood by the vertebral arteries, which derived it, through the basilar artery, from the carotids. The cessation of the pulse during the paroxysm proved that the circulation through these vessels was temporarily interrupted. Does any similar interruption occur in poisoning by hydrocyanic acid?

ζ. *Cause of death.*—In most cases the immediate cause of death is obstruction of respiration. In some instances it is stoppage of the heart's action. There are cases, however, in which the death is too immediate to be produced by obstructed respiration, while, on opening the chest, the heart is found still beating: this I have observed in experiments on rabbits with strong hydrocyanic acid.

η. *Cumulative effects.* — Hydrocyanic acid is not usually regarded as a cumulative poison; but a case mentioned by Dr. Baumgärtner (quoted by Dr. Christison), as well as some other circumstances, seem to favour the reverse opinion.[1]

USES. — We are indebted to the Italians (Borda, Brugnatelli, and Rasori) for the introduction of hydrocyanic acid into the Materia Medica. It was first employed by them at the commencement of the present century; namely, from 1801 to 1806.[2]

α. *Internal.* — By the founders of the theory of contrastimulus this acid was regarded as a powerful asthenic or contrastimulant, and, therefore, as peculiarly useful in all diseases dependent on, or connected with, excitement. Hence it was employed in inflammatory affections. But subsequent experience has fully shown that in these cases it possesses little or no remedial power. In this country, the reputation of hydrocyanic acid as a medicinal agent is chiefly founded on its effects in alleviating certain painful (neuralgic) and spasmodic stomach complaints. It appears from Dr. Granville's statements,[3] that laurel water (which contains this acid) was used in these affections by Hufeland, Haller, Thuessen, Swediaur, and Sprengel, between the years 1780 and 1796. But the first person who actually recommends hydrocyanic acid for them is Sprengel,[4] in 1814. In 1819, Dr. A. T. Thomson detailed a case which led him to infer that this acid would be an important agent in the treatment of dyspeptic affections. But the profession are principally indebted to Dr. Elliotson[5] for a full investigation of its powers in these complaints.

Every practitioner is familiar with a stomach complaint in which pain of a spasmodic character is the leading symptom, but which is not essentially accompanied by pyrexia, as in gastritis—by tendency to faint, as in cardialgia—by indigestion, as in dyspepsia, nor by loss of appetite;

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[1] See Dr. Christison's *Treatise.*

[2] Granville, *Treatise on Hydrocyanic Acid,* 2d edit. 1820.

[3] *Op. cit.*

[4] *Pharmacologia.*

[5] *Numerous Cases illustrative of the Efficacy of the Hydrocyanic Acid in Affections of the Stomach,* 1820.

though one or more of these conditions may attend it. By some nosologists (as Sauvage and Sagar) it has been regarded as a distinct disease, and has been termed *gastrodynia.* It is not unfrequently accompanied by vomiting and præcordial tenderness, which, however, cannot be regarded as indicative of inflammation, for various reasons; one of which is the alleviation of it often obtained by the use of stimulants and antispasmodics. What may be the precise pathological condition of this malady I know not. Dr. Barlow[1] thinks the primary disease to be irritation or excitement of the mucous membrane of the stomach, whereby a redundant, dense, membranous, and opaque mucus is secreted, which accumulates and oppresses the stomach. The pain he supposes to arise from a contractile effort of the stomach to detach and expel the offending matter: but the immediate and permanent relief sometimes obtained by the use of hydrocyanic acid is, I conceive, almost fatal to this hypothesis. Some time since I prescribed the acid for a lady who had suffered for months with gastrodynia, and who was persuaded, from her sensations, that she had some organic disease. The remedy acted in the most surprising manner: in a few hours, to the astonishment of herself and friends, she was apparently quite well, and has since had no return of her complaint. It can hardly be imagined that irritation of stomach can be rapidly removed by a substance which is itself an irritant. For my own part, I conceive the affection to be, essentially, a disordered condition of the nerves supplying the stomach, or of the nervous centres from whence those nerves are derived: in other words, it is a gastric neuralgia. It is frequently, but not invariably, accompanied by the irritation of stomach alluded to by Dr. Barlow. But be the proximate cause of the disease what it may, the beneficial effects of the hydrocyanic acid, in some instances of it, are most astonishing; while in others it totally fails. In all the cases in which I have tried it, I have obtained either perfect success or complete failure: I have met with no cases of partial relief. It not only allays pain, but relieves vomiting; and in the latter cases, frequently when all other remedies fail. Dr. Elliotson mentions the following as the stomach affections relieved by it:—1st, those in which pain at the stomach was the leading symptom: 2ndly, those in which the gastrodynia was accompanied by a discharge of fluid, constituting what is called pyrosis, or the water-brash: 3dly, when the excessive irritability of the stomach produces vomiting: and 4thly, those disorders of the stomach which, in some of their symptoms, resemble affections of the heart. The late Dr. Prout found it useful in gastrodynia connected with colica pictonum.

I have also found it useful in a painful affection of the bowels analogous to that of the stomach, and which, therefore, might with propriety be termed *enterodynia.* The most remarkable case of this kind which I have met with was that of a gentleman, a relative of one of my pupils. He had suffered, for several months, excruciating pain in the bowels, commencing daily about two o'clock, and only ceasing at night. It was apparently a consequence of an ague. He had been under the care of several country practitioners, and had tried a number of remedies (including opium and disulphate of quina) without the least benefit. I advised the employment of the hydrocyanic acid, and accordingly five minims were administered at the commencement of a paroxysm. The remedy acted like a charm: all the unpleasant symptoms immediately disappeared. Several doses of the acid were given before the period of the succeeding paroxysm, but the disease never returned; and after employing the acid for a few days longer, he went back to the country completely cured. I have seen hydrocyanic acid used with great success to allay vomiting and purging in severe forms of the ordinary English *cholera*, when opium has completely failed. In Asiatic or malignant cholera it has occasionally appeared to be serviceable. I have found it successful in checking the diarrhœa of phthisical subjects, when logwood, chalk, and opium had failed. As a remedy for affections of the pulmonary organs, hydrocyanic acid was at one time in great repute. It was said to be capable of curing slight inflammation of the lungs, without the necessity of bloodletting; of suspending or curing incipient phthisis, while in confirmed cases it smoothed the approach of death; of curing hooping-cough, and of removing all the symptoms of spasmodic asthma.[1] Experience has shown the fallacy of most of these statements. I have employed hydrocyanic acid in a considerable number of cases of phthisis, and have occasionally fancied that it relieved the cough and night-sweats; but these effects were only temporary. Cases of genuine spasmodic asthma are rare; but in two instances in which I have seen the acid employed no relief was obtained. In allaying cough (especially the kind called spasmodic) I have, on several occasions, found it useful; but it has so frequently disappointed my expectations, that I now rarely employ it in any pulmonary diseases. I have never observed any ill effects from its use in these cases, though others assert they have. Dr. Roe[2] ascribes to this acid the power of curing simple hooping-cough; that is, convulsive cough unaccompanied by inflammatory symptoms. He gives it in conjunction with ipecacuanha and tartarized antimony. In two or three days after the use of these remedies, the violence of the paroxysms, he says, is perceptibly diminished, and their duration shortened. To a girl of ten years of age he gave a minim and a half of the acid every quarter of an hour, for twelve hours. I have not found this practice so successful as Dr. Roe's reports would lead us to expect.

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[1] *Cyclopædia of Practical Medicine*, art. *Gastrodynia.*

This acid has been employed in affections of the *nervous system*. Cases of hysteria, epilepsy, chorea, and tetanus, have been published, in which this remedy has been found beneficial. I have seen it employed in the three first of these affections, but without any evident relief. It has been repeatedly used in hydrophobia, at the London Hospital, but without success. A most interesting case of its employment in this malady has been published in the *Lancet* (for May 10th, 1839). Under its use the hydrophobic symptoms subsided, and typhus supervened, of which the patient, after some days, died. Dr. Hall[3] proposes that in addition to the use of this acid, tracheotomy, as suggested by Dr. Mayo, should be tried. Hydrocyanic acid has been administered as an *anodyne* in several painful affections; namely, cancer, tic-douloureux, rheumatism, &c.; but, with a few exceptions, it has not been found serviceable. As an *anthelmintic* it has been extolled by Brera; but the following fact, mentioned by Dr. Elliotson, will, I imagine, show its true value:—"I have frequently employed it perseveringly without expelling one worm, when a dose of calomel has instantly brought away hundreds."

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[1] See Dr. Granville's *Treatise*, before referred to; and also Magendie's *Recherches sur l'Emploi de l'Acide Prussique*, 1819.

[2] *A Treatise on the Nature and Treatment of the Hooping-Cough*, Lond. 1838.

[3] *Lect. on the Nerv. Syst.* p. 155.

β. *External.*—The local employment of the acid has not been attended with very great success. In chronic skin diseases, especially impetigo, prurigo, and psoriasis, the acid has been recommended by Dr. A. T. Thomson to allay pain and irritation. Schneider, of Dusseldorf, has employed one drachm and a half of hydrocyanic acid, six ounces of spirit, and as much rose water, in scaly diseases attended with severe itching, especially in eruptions upon the genital organs. On several occasions I have tried hydrocyanic washes in prurigo, but without obtaining any relief. Dr. Elliotson says he has found it efficacious in sores behind the ears, and in scabs of the face; and adds, to an irritable face it is very soothing, if employed before and after shaving. In cancer of the uterus, lotions containing this acid have been employed to allay the pain, by Frisch, of Nyborg. Osiander has also employed, in the same disease, cherry-laurel water, the active principle of which is this acid. In gonorrhœa, injections containing hydrocyanic acid have been employed with benefit. Schlegel has tried also the cherry-laurel water with the same result. Lastly, the diluted acid has been proposed as an effectual mode of destroying vermin.

ADMINISTRATION.—The best mode of exhibiting this acid internally is in the form of mixture. I generally give from three to five minims of the diluted acid, *Ph. L.*, three or four times a day, in about an ounce of some mild vehicle (simple water answers very well). Gum or syrup, and some flavouring ingredients (as orange-flower water, which is used on the continent), may be added. Some persons give it in almond emulsion. In some cases of irritable stomach this is objectionable.

As a wash, two fluidrachms of the diluted acid of the shops may be employed, mixed with half a pint of distilled (or rose) water, as a lotion, in skin diseases. Frequently about half an ounce of rectified spirit is added; and Dr. A. T. Thomson recommends, in addition to this, sixteen grains of acetate of lead. The external use of this acid, in all cases (more especially if there be sores) requires great caution. Its effects on the nervous system and on the pulse must be carefully watched. In some cases it causes giddiness and faintness; and Mr. Plumbe says, in two instances it produced intermission of the pulse.

[DOSE.—This necessarily varies with the kind of acid employed. The dose of the acid of the London College may be taken at from two to seven minims; of the Edinburgh College, from one to four minims; and of the Dublin College, from one to five minims.—ED.]

ANTIDOTES.—The most important agents in the treatment of poisoning by hydrocyanic acid, as well as by the substances which contain it (viz. the cherry-laurel, bitter almonds, the volatile oil of these substances, &c.), are *chlorine*, *ammonia*, *cold affusion*, and *artificial respiration*.

α. *Chlorine* is the most powerful of these. It was first proposed by Riauz in 1822. It has been subsequently strongly recommended by Buchner, Simeon, and Orfila. It should be applied both internally and externally, if possible. If chlorine water be at hand, this should be given in doses of one or two tea-spoonfuls properly diluted with water. In the absence of this, weak solutions of the chloride [hypochlorite] of lime, or the chloride [hypochlorite] of soda, may be administered. Nitro-hydrochloric acid, largely diluted, might be given where none of the above agents could be procured. The patient should be allowed to inhale, very cautiously, air impregnated with chlorine gas (developed by the action of dilute hydrochloric acid on chloride of lime). Enemata containing chlorine water, or a solution of chloride of lime, should also be employed.

β. *Ammonia.*—The spirit of sal ammoniac was proposed by Mead[1] as an antidote for laurel water. In 1822, ammonia was recommended by Mr. J. Murray as an antidote for hydrocyanic acid; and its value has been admitted by Buchner, Orfila, Dupuy and Herbst; but it is certainly inferior to chlorine, and, therefore, should be used only in the absence of this. If the patient should be able to swallow, the liquor ammoniæ, diluted with eight or ten parts of water, should be exhibited, and the vapour of ammonia or its carbonate inhaled; the latter practice is most important, and should not be omitted. Orfila says that ammonia is of no use when introduced into the stomach, but that the inhalation of the vapour will sometimes preserve life. Great caution is requisite in the employment of it. In the absence of ammonia the inhalation of the vapour of burnt feathers might be employed. Ammonia cannot be useful, as an antidote, by its chemical properties merely, since hydrocyanate of ammonia is a powerful poison.

γ. *Cold Affusion* has been strongly recommended by Herbst,[2] and is admitted by Orfila to be a valuable remedy. Herbst says that its efficacy is almost certain when it is employed before the convulsive stage of poisoning is over, and that it is often successful even in the stage of insensibility and paralysis. [This statement has been confirmed by the results of experiments on animals.—ED.]

δ. *Artificial Respiration* ought never to be omitted. Of its efficacy I am convinced from repeated experiments on animals. I once recovered a rabbit by this means only, after the convulsions had ceased, and the animal was apparently dead. It is an operation easily effected, and will be found a powerful assistant to chlorine or ammonia, by enabling it to get into the lungs when natural respiration is suspended. To produce respiration, make powerful pressure with both hands on the anterior surface of the chest, the diaphragm being at the same time pushed upward by an assistant. Inspiration is effected by the removal of the pressure and the consequent resiliency of the ribs.

Other remedies (as turpentine, and the mixed hydrated oxides of iron) have been recommended, but they will not bear comparison with those now mentioned. Blood-letting has been advised, in vigorous subjects, when respiration has been established, and the skin is livid.[1]

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[1] *Mechan. Account of Poisons*, 5th edit. 275, 1756.
[2] *Archiv f. Anat. u Phys.* 1828; quoted by Dr. Christison.

268. PERSICA VULGARIS, *Miller.*—THE PEACH.

Amygdalus Persica, *Linn.*

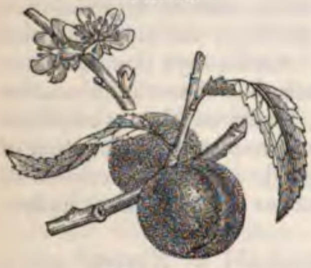
Sex. Syst. Icosandria Monogynia.

[Although no longer to be found in the British Pharmacopœias, we have retained the author's remarks upon this fruit.—ED.]

HISTORY.—Both Dioscorides[2] and Pliny[3] speak of the peach: the former terms it περσικὸν μῆλον; the latter *malum persicum.*

BOTANY. **Gen. Char.**—The same as *Amygdalus,* except that the *drupe* is very fleshy. *Epicarp* either velvety or quite smooth. *Putamen* (stone) extremely rugose, with furrows (De Cand.)

FIG. 50.



The Peach.

Sp. Char.—*Fruit* tomentose (De Cand.) A small *tree.* *Leaves* lanceolate, serrate or crenate, with or without glands. *Flowers* roseate, large or small.[4] Both flowers and kernels exhale the bitter almond odour.

Two varieties of the peach are usually made. These are admitted by De Candolle:—

α. *Melters or Free-stones.*—Flesh separating from the stones.

β. *Cling-stones* or *Pavies.*—Flesh adherent to the stone.

The *Nectarine* (*Persica lævis,* De Cand.) is distinguished from the Peach by its smooth fruit. This trivial distinction leads many botanists to regard these two fruits as varieties of the same species.

Hab.—Native of Persia. Cultivated in gardens. Flowers in April or May.

DESCRIPTION.—*Peach leaves* (*folia persicæ*) have the peculiar odour and taste of the bitter almond. The *kernels* (*semina persicæ*) closely resemble the latter, both in appearance and properties, but are smaller. The *flowers* (*flores persicæ*) lose the greater part of their odour by drying.

COMPOSITION.—The *leaves* have not been analysed. They yield, by distillation, a volatile oil (*oleum folii persicæ*) which is yellow, heavier than water, and contains hydrocyanic acid.[5] After eight years a crystalline substance was found on the water.[6] The non-ligneous extremities of the *twigs* of the peach-tree yielded Gauthier[1] 1·92 per cent. of very volatile oil, which was heavier than water. Berard[2] analysed the juice of the peach, both in the ripe and unripe states: the constituents were, *colouring matter, sugar, gum, vegetable fibre, albumen, malic acid, lime,* and *water.*

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[1] Devergie, *Méd. Lég.* t. ii. p. 825; also Lonsdale, *op. supra cit.*

[2] Lib. i. cap. 164.

[3] *Hist. Nat.* lib. xv. cap. 11, et seq. ed. Valp.

[4] See Loudon, *Encycl. of Gardening.*

[5] Gmelin, *Handb. d. Chem.* ii. 400.

[6] Brugnatelli, *Ann. Chem.* xcvi. 96.

PHYSIOLOGICAL EFFECTS. — The highly palatable *flesh* of the peach is nutritious (on account of its sugar, gum, &c.), and slightly refrigerant (from the malic acid which it contains). Taken in moderate quantities it is wholesome, but if eaten too freely it is apt to disorder the bowels. The *kernels,* the *blossoms,* the *leaves,* and the *bark,* possess poisonous properties. The flowers, as well as the leaves, in the form of infusion, have been used to purge and destroy intestinal worms, especially in children;[3] but their employment has sometimes been attended with fatal results. Bertrand[4] says, that a child, eighteen months old, experienced convulsions, vomiting, and bloody diarrhœa, from the use of a strong decoction of the flowers; and Coullon[5] states, that an elderly gentleman, having partaken of a salad of the flowers, was seized with giddiness, violent purging, convulsions, and stupor, and died in three days. The irritation of the alimentary canal, manifested by vomiting and purging, and the slow death, distinguish the operation of the peach flowers from that of hydrocyanic acid. The same author[6] also states, that the peach-bark proved injurious to a cock, and caused difficulty of breathing, and purging.

USES. — The *fruit,* both fresh and preserved, is employed as a dessert. Its use is objectionable in gouty persons, and in those whose bowels are easily disordered. When stewed with sugar, it may be given as a mild laxative to convalescents. The *kernels* may be used as the bitter almond. The *blossoms* are scarcely ever administered in this country; but they have been recommended as a vermifuge. The *leaves* are sometimes employed by the cook and liqueur-maker, for flavouring. They have also been used as a substitute for China tea.[7] They have been recommended as a vermifuge, and more recently to allay irritation of the bladder and urethra.[8]

ADMINISTRATION. — The dose of *peach-blossoms* is half an ounce of the fresh, or a drachm of the dried, flowers, infused in water.[9] The dose of the *infusion of peach-leaves* (prepared by digesting ℥ss. of the dried leaves in Oj. of boiling water) is f℥ss. three times a day.

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[1] *Journ. de Pharm.*

[2] Thomson, *Org. Chem.* 890.

[3] Costet et Willemet: quoted by Murray, *App. Med.* iii. 245

[4] Wibmer, *Wirk. d. Arzneim. u. Gifte,* Bd. iv. S. 190.

[5] Christison, *Treatise on Poisons,* p. 726.

[6] Wibmer, *op. supra cit.*

[7] Murray, *App. Med.*

[8] See also *Lond. Med. Rev.* vol. iv. p. 81, Lond. 1800.

[9] Murray, *op. supra cit.*

269. PRUNUS DOMESTICA, *Linn. L. E. D.*—THE PLUM TREE.

Sex. Syst. Icosandria Monogynia.

(Fructus præparatus, *L.*—Dried fruit, *E.*—Fructus siccatus, *D.*)

History.—Dioscorides[1] calls this tree the *κοκκυμηλέα*, while the fruit he terms *κοκκύμηλον*.

Botany. **Gen. Char.**—*Drupe* ovate or oblong, fleshy, quite smooth, covered with a pruinose powder. *Putamen* (stone) compressed, acute on both sides, somewhat furrowed at the edges, otherwise smooth. Young *leaves* convolute. *Pedicels* umbellato-fasciculate, 1-flowered, evolved before or after the leaves (De Cand.)

Sp. Char.—*Flowers* almost solitary. *Leaves* lanceolate-ovate, convolute. *Branches* not spinous (De Cand.)—A small *tree*. *Flowers* white.

Gardeners cultivate several hundred varieties.[2] De Candolle admits the following varieties:—

α. *Armenioïdes*, including the *Mirabelle Plum.*
β. *Claudiana*, including the *Green Gage.*
γ. *Myrobalana*, including the *Myrobalan Plum.*
δ. *Damascena*, including the *Damask Plum.*
ε. *Turonensis*, including the *Orleans Plum.*
ζ. *Juliana*, yields the *Officinal Prune.*
η. *Catharinea*, including the *St. Catharine Plum.*
θ. *Aubertiana*, including the *Magnum Bonum* or *Mogul Plum.*
ι. *Prunealina*, including the *Damson.*

Hab.—South of Europe. Cultivated in gardens and orchards.

Description.—The dried fruits of the *Prunus domestica* are called *prunes* (*fructus siccatus pruni; drupæ siccatæ pruni*). In warm countries they are dried on hurdles by solar heat; but in colder climates artificial heat is employed. In France both methods are adopted; the fruit being exposed to the heat of an oven and to that of the sun, on alternate days. *Table prunes* are prepared from the larger kinds of plum—as the Saint Catharine and the Reine-Claude (Green Gage): *Medicinal prunes* from the Saint Julien (*P. domestica*, var. ζ *Juliana*). The former have an agreeable, very sweet taste; the latter are somewhat austere. They are principally imported from Bourdeaux. The part employed in medicine is the *pulp* (*pulpa pruni*).

Composition.—John[3] analysed the Mirabelle Plum, and Berard the Reine-Claude (Green Gage), both in the ripe and unripe states.[4] The constituents of the ripe fruit, according to the last-mentioned chemist, are, *sugar* 11·61, *gum* 4·85, *albumen* 0·93, *malic acid* 1·10, *vegetable fibre* 1·21, *lime* a trace, *water* 80·24, [loss 0·06].—*Pectin* is also a constituent of these fruits.

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[1] Lib. i. cap. 174.

[2] Don (*Syst. of Gard.* ii. 499) mentions 270 varieties.

[3] Gmelin, *Handb. d. Chem.* ii. 1269.

[4] Thomson, *Org. Chem.* 890.

PHYSIOLOGICAL EFFECTS.—Fresh ripe plums, taken in moderate quantities, are wholesome and nutritive; but in large quantities they readily disorder the bowels. The immature fruit still more easily excites ill effects. The medicinal prune is a mild laxative.

USES.—The finer kinds of plums are employed at the table as a delicious dessert; the inferior qualities are used in pies, tarts, conserves, and sweetmeats. The larger prunes are employed at the table as a dessert; the medicinal prunes are employed as an agreeable and mild laxative for children, and during convalescence from febrile and inflammatory disorders. They are sometimes added to cathartic decoctions or infusions (as *infusion of senna*), to improve the flavour, and promote the purgative effect. They enter into the composition of the *confection of senna.*

270. CERASUS LAURO-CERASUS, *Loisel.*—THE COMMON OR CHERRY-LAUREL.

Prunus Lauro-cerasus, *Linn. D. E.*
Sex. Syst. Icosandria Monogynia.
(Leaves, *E.*—Folia, *D.*)

HISTORY.—Belonius terms this plant the *Cerasus trapezuntina.*[1] It was introduced into Europe, from Trebizonde, in 1576.

BOTANY. **Gen. Char.**—*Drupe* globose or umbilicate at the base, fleshy, quite smooth, not covered with a pruinose powder. *Nucleus* (stone) somewhat globose, smooth.—Young *leaves* conduplicate. *Pedicels* 1-flowered or ramose (De Cand.)

Sp. Char.—*Racemes* shorter than the leaves. *Leaves* ovate-lanceolate, remotely serrate, with two or four glands beneath. *Fruit* ovate, acute (De Cand.)

An evergreen *under shrub.* Smooth in every part. *Leaves* short-stalked, coriaceous, shining. *Petals* roundish, spreading white. *Fruit* black, the size of a small cherry.

Hab.—Trebizonde. Common in gardens everywhere.

DESCRIPTION.—Cherry-laurel leaves (*folia lauro-cerasi*) have scarcely any odour until bruised, when they give out the characteristic or bitter almond odour of the plant. Their taste is very bitter, aromatic, and slightly astringent. By drying they lose their odour, but retain their flavour. Their watery infusion is rendered green by the sesquichloride of iron.

COMPOSITION.—I am unacquainted with any complete analysis of cherry-laurel leaves. They were imperfectly examined in 1797 by L. J. Spandaw du Celliée.[2] In 1802, Schrader[3] discovered hydrocyanic acid in the volatile oil obtained from them. The recent researches into the origin of the volatile oil of the bitter almond (see *ante*), render it probable that the volatile oil of the cherry-laurel does not pre-exist in

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[1] Sprengel, *Hist. rei herb.* i. 377.
[2] Pfaff, *Mat. Med.* Bd. v. S. 152.
[3] *Ibid.* S. 151.

[illegible] to [illegible] of the [illegible] matter,

[illegible] distillation [illegible] aqua [illegible] hydrocyanic [illegible] are produced [illegible] amygdalin, [illegible] probable; [illegible] attracts [illegible] It [illegible] salt. [illegible]

[illegible]

[illegible]

[illegible]

by hydrocyanic acid; viz. painful sensation of the stomach, sudden insensibility, and death within a few minutes. Convulsions, however, have not been frequent. In the case referred to by Dr. Madden,[1] in which brandy, mixed with a fourth part of cherry-laurel water, proved fatal, there was no vomiting, purging, or convulsions. But in the instances mentioned by Fodéré,[2] the individuals expired in convulsions. The effects of medicinal doses of cherry-laurel water are stated to be similar to those of small doses of hydrocyanic acid.

USES.—Cherry-laurel leaves are not unfrequently employed by the cook for flavouring. Though the distilled water of the cherry-laurel is contained in the Edinburgh and Dublin Pharmacopœias, yet it is rarely employed in medicine in this country. It is applicable to all the cases for which hydrocyanic acid has been used. It has been used as a sedative narcotic in tic-douloureux, phthisis pulmonalis, spasmodic cough, and palpitation of the heart.

AQUA LAURO-CERASI, E. D.; *Water of Cherry Laurel; Laurel Water.* (Fresh leaves of the Common Laurel, lbj.; Water, Oiiss. Upon the leaves, chopped, and crushed in a mortar, macerate the water for 24 hours, and then draw over a pint of liquid by distillation, using a Liebig's condenser, and chloride of zinc bath. Filter the product through paper, and preserve it in a well-stopped bottle, *D.* The compound spirit of lavender is added as a colouring ingredient, by the Edinburgh College, to prevent the preparation being mistaken for common water. In other respects the process is essentially the same as in the Dublin Pharmacopœia.)—Dose fʒss. to fʒj. The strength, and, therefore, the dose, are, however, liable to considerable variation. Fouquier[3] has, in some cases, given twelve ounces during the day, without any evident effect.

[271. CERASUS SEROTINA, *De Cand.*—WILD CHERRY.

Sex. Syst. Icosandria Monogynia.

(Prunus Virginiana, U. S. Wild Cherry Bark.)

Not a little confusion has existed among botanists with respect to the name of this tree, from its having been confounded with a species closely allied to it, the *C. virginiana* of De Candolle, or Choke Cherry, which latter was described by Linnæus under the title of *Prunus virginiana*, but by which he was supposed to have designated the *Wild Cherry*, and hence the adoption of that designation for the plant under consideration; the name *P. serotina* being given to the other species. The transposition of names originated with Michaux, who mistook the *Wild Cherry* for the *P. virginiana*, and called it *Cerasus virginiana*. The error has been fully explained and corrected from De Candolle by Drs. Torrey and Gray in the Flora of North America. The authors of the last edition of the United States Pharmacopœia have not thought it expedient at present to change the official title for the bark of the tree, as it has been sanctioned by custom for so long a period as to render it almost an impossibility to introduce a new one.

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[1] *Phil. Trans.* for 1731.

[2] Orfila, *Toxicol. Gén.*

[3] Richard, *Elém. d'Hist. Nat.* ii. 447.

Botany. Gen. Char.—As in *Cerasus Lauro-Cerasus.*

Sp. Char.—*Leaves* (rather coriaceous) oval-oblong or lanceolate-oblong, acuminate, glabrous, or bearded along the midrib beneath, smooth and shining above, finely serrate, with appressed or incurved callous teeth; *petioles* (or base of the leaf) mostly with two or more glands; *racemes* elongated, spreading; *petals* broadly obovate; *drupes* globose, purplish black.[1]

[illegible]—The Wild Cherry is an inhabitant of the United States, where it is disseminated from Canada to Florida, and through the Western States.

It varies in height from twenty-five to eighty or more feet, attaining its extreme proportions in the south-western portion of the Union. The *leaves* are 2—4 inches long; *racemes* 2—5 inches in length, and nodding at their termination. *Flowers*, white and fragrant, appearing in May. The bark of the tree is of a dark ashy hue on the trunk, where it is rough; smooth and dark upon the branches. The epidermis is readily separable, and peels off when detached circularly, leaving the green cellular tissue beneath. By this character it can be detected in the forests. The wood is hard, and valuable in the construction of furniture. The fruit has a sweet, somewhat prussic, and slightly bitter taste. It is used for flavouring liquors.

The bark of the branches or of the root is employed for medicinal purposes. The latter is regarded as best. It is collected by the herb-venders, and brought into the market in pieces or fragments several inches long, and from half an inch to two in width. From drying it becomes somewhat curved laterally. It is destitute of the epidermis, of a reddish-brown colour, brittle and pulverisable; fracture short, and presenting greyish surfaces. When fresh the odour is prussic, which is in a measure lost by drying, but regained by maceration. The taste is aromatic, prussic, and bitter.

Composition.—The first satisfactory analysis of this bark was made by Mr. Stephen Procter[2], who found it to contain starch, resin, gallic acid, tannin, fatty matter, lignin, red colouring matter, salts of lime, potassa, and iron. By distilling the bark with water, a volatile oil was obtained, associated with hydrocyanic acid. More recently[3], Mr. William Procter has shown that the volatile oil is composed of *hydruret of benzule and hydrocyanic* acid, like oil of bitter almonds, and that they *do not pre-exist* in the bark, but are products of the decomposition of *amygdalin*; the same principle that exists in the bitter almond, by the reaction of *emulsin*.

Oil of Wild Cherry. — This oil has a light straw-colour, a pungent taste, and an odour strongly resembling that of bitter almonds.

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[1] *T. & G. Flor. North Amer.* p. 411.

[2] *Journal of Philad. Col. of Pharmacy*, vol. vi. p. 8.

[3] *Op. cit.* vol. ix. p. 300, and x. p. 197.

When deprived of hydrocyanic acid by distillation with a mixture of proto-chloride of iron, potassa, and water, it is without any poisonous properties. Its sp. gr. is 1·046.

It is presumable that bitter extractive matter exists in it, and it has been suggested that phloridzine is also a constituent. It yields its virtues to water and alcohol.

MEDICAL PROPERTIES. — Dr. B. S. Barton informs us[1] that the leaves of this tree are poisonous to certain animals, as calves, and even the berries intoxicate different kinds of birds.

The bark is tonic and invigorating in its impression upon the stomach and the general system, but at the same time is regarded as exercising a sedative or depressing influence upon the circulation and nervous apparatus, which last effect is attributed to the action of the hydrocyanic acid.

From the experiments of Dr. Morris, who made it the subject of his inaugural dissertation (1802), it appears that the primary impression upon the pulse was an increase of rapidity, but that when it had been continued for some time it became fuller and stronger; in cases where some previous excitement existed, the rise of the pulse was steady, and in all his experiments the medicine was pushed until drowsiness came on. Half-drachm doses of powdered bark were exhibited. This primary stimulant operation is concurred in by Dr. Eberle, who states, however, that when taken in large quantities and repeated frequently, it weakens the digestive powers, and produces an effect upon the action of the heart and arteries the reverse of stimulant; that in his own person he several times reduced his pulse from seventy-five to fifty strokes in a minute, by copious draughts of the cold infusion, taken several times during the day, and continued for twelve or fourteen days.[2] There must certainly be considerable difference of action between the powdered bark, in which the astringent and bitter principle is concentrated, and the hydrocyanic acid with difficulty eliminated, and the cold infusion, in which the latter principle has an opportunity of being fully generated.

USES.—From its little stimulating properties, but, on the contrary, its power of allaying irritation, particularly of a nervous kind, it has been employed in a number of diseases connected with a debilitated state of the system. As a commencing tonic in the convalescence from fever or inflammatory attacks, it may frequently be ventured upon, when other roborants are inadmissible. This is especially the case where the attack of the disease has been pulmonary, and where any excitement of the circulation cannot but be prejudicial, as in Pneumonia, Bronchitis, &c. To Phthisis it is regarded as being peculiarly adapted, and by several eminent writers is highly spoken of; thus, we are informed by Dr. Eberle, that "it lessens the frequency, tension, and irritated state of the pulse; moderates the cough and profuse nocturnal perspirations; checks the diarrhœa, and sustains the general strength of the system;" the same also is the testimony of Dr. Chapman. In hectic fever, from whatever cause proceeding, analogous results may be expected.

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[1] *Collections*, p. 11.

[2] *Treat. on Mat. Med.* vol. i. p. 272.

[illegible] impression [illegible] however, be but [illegible] to diminish [illegible] that the wild [illegible] fever; this is [illegible] who have been [illegible] in the coun- [illegible] comparison, never- [illegible]

[illegible] of the powder. [illegible] prussic [illegible] best form of [illegible]

[illegible] Bark. [illegible] ounce; [illegible] This [illegible] is in this [illegible] is a beauti- [illegible] flavour, [illegible] more, re- [illegible]

[illegible] Bark. [illegible] Sugar, ℔ ij.; [illegible] with water, [illegible] transfer it to a [illegible] of filtered [illegible] agitate occa- [illegible] introduced by [illegible] been employed by [illegible] pleasant [illegible] coughs and pulmonary [illegible]

[illegible]

[illegible] TRIFOLIATA. [illegible]—INDIAN PHYSIC.

[illegible]

[illegible]

[illegible] border five-toothed. *Corolla,* [illegible] attenuated, coarctate at the [illegible] Styles five, contiguous. *Stigmas* [illegible] *Capsule* [illegible] two-seeded. Nuttall.)

[illegible] p. 11.
Op. cit. p. 272.
Am. Journ. Pharm. vol. xiii. p. 627.

Sp. Char.—*Leaves* ternate, upper folioles lanceolate, serrate, subequal; lower folioles obtuse, with an abrupt, acute termination. *Stipules* linear, entire. *Flowers* terminate, loosely paniculated, five-gynous. *Petals* linear, lanceolate, obtuse. *Calyx*, tubulose, campanulate, ventricose. *Stamina*, included. *Capsule* five-celled, many-seeded.

This plant is the *Spiræa trifoliata* of Linnæus, but the generic name was altered by Moench to the present one. The common names are *Indian physic*, *Indian hippo*, *Dropwort*, and *Bowman's Root*.

Hab. — This species is found scattered over the United States from Canada to Florida, on the eastern side of the Alleghany Mountains, occurring in open hilly woods, in light gravelly soil. The period of flowering is May, and the fruit is matured in August. The flowers are white, or of a rose tint.

The root is perennial, composed of a great number of fibres, arising from a common rough and irregular dark-coloured tube or head. These fibres are about the thickness of straws, many inches in length, irregular in thickness, with somewhat of an undulated form. When dried, the root is of a reddish-brown colour, wrinkled, and composed of an easily separable cortical portion and an internal ligneous cord. The external part is readily reduced to powder. It has a feeble odour and a bitter taste.

CHEMICAL COMPOSITION. — Some experiments upon the root of Gillenia trifoliata have been made by Mr. Shreeve,[1] who found that it contained *starch*, *gum*, *resin*, *wax*, *fatty matter*, *red colouring matter*, *volatile colouring matter*, and *a peculiar principle* soluble in alcohol and the dilute acids, but insoluble in water and ether. It contains nothing like *emetina*, according to the statement of Dr. Staples.

MEDICAL PROPERTIES.—Gillenia is a safe emetic, operating without violence in the appropriate dose. In small doses it is a stimulant and tonic to the stomach. It is stated that a knowledge of its medicinal operation is derived from the aborigines.

USES. — Although the testimony is strong in favour of the decided medicinal action of the root under consideration, its claims to confidence have been shaken by the report of Dr. Baum, who experimented with it, and was led to the conclusion that too much power had been attributed to it. Dr. Griffith[2] remarks, however, that he does not think Dr. Baum's experiments are sufficient to induce us to reject an article which has received the united testimony of the members of the profession, who speak of it in the highest terms, and recur to its use with as much confidence as to the true Ipecacuanha. The statements in its support are by Dr. B. S. Barton,[3] who says: "I can speak with more confidence of the Spiræa trifoliata. It is a safe and efficacious emetic in doses of thirty grains. Along with its emetic it seems to possess a tonic power." And Dr. W. C. P. Barton declares that country people have frequently used the plant so incautiously as to be under the necessity of resorting to medical aid.[4] Dr. Eberle observes: "From my own experience with this plant, which has not been inconsiderable, I am led to regard it as very little inferior to the officinal Ipecacuanha as an emetic." To these may be added, Dr. Zollickoffer and Professor Bigelow.

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[1] *Am. Journ. of Pharmacy*, vol. vii. p. 28.

[2] *Ibid.* vol. iv. p. 181.

[3] *Collections*, p. 27.

[4] *Veg. Mat. Med.* U. S. vol. i. p. 69.

The cases to which it is applicable are intermittent and remittent fevers, in commencing stages, and bowel affections, as diarrhœa and dysentery. It may also be beneficial in some forms of dyspepsia.

ADMINISTRATION. — The mode of administration is in the form of powder or strong infusion. The dose of the powder is gr. xxx. for its emetic effect; in doses of grs. ij. or grs. iv. it acts as a tonic.

The *Gillenia stipulacea* replaces the G. trifoliata on the western side of the Alleghany range. It is readily distinguished by the pinnatifid lower leaves, the upper being trifoliate, incised, serrate; and the foliaceous, oblique, jagged, stipules. The root is analogous to the preceding, and may be used under the same circumstances.—ED.]

TRIBE III. DRYADEÆ.

273. GEUM URBANUM, *Linn.*—COMMON AVENS. HERB BENNET.

Sex. Syst. Icosandria Polygynia.

HISTORY.—Pliny[2] speaks of the medicinal properties of Geum.

BOTANY. **Gen. Char.**—Tube of the *calyx* concave; limb 5-cleft, externally 5-bracteolate. *Petals* 5. *Stamens* numerous. *Carpels* juiceless, tailed, disposed in a head. *Style*, after flowering, articulate or barbed. *Seed* ascending.—*Herbs. Leaves* variously pinnatisect (De Cand.)

Sp. Char.—*Stem* erect, branched, hairy. *Leaves* radical quinate-pinnatisect; caulinar ones ternate-palmatisect, with ovate broadly toothed crenate-lobes; upper ones 1-lobed, ovate. *Stipules* somewhat orbicular, large. *Petals* ovate, as long as the calyx. Capillary *head* spherical. *Ovaries* hairy, numerous. *Styles* smooth, with somewhat hairy appendices (De Cand.)

Root of many brown fibres. *Stem* 1 or 2 feet high. *Leaves* grass-green, veiny, hairy. *Flowers* terminal, solitary. *Petals* bright-yellow.

Hab.—Indigenous. Growing in woods, hedges, and dry shady places.

DESCRIPTION.—The root (*radix caryophyllatæ*, seu *gei urbani*, vel *sanamundæ*) consists of a rootstalk of from one to three inches long, from which issue a considerable number of cylindrical fibres. Externally it is brownish; internally, reddish. When recent, its odour is aromatic and clove-like; but this is greatly diminished by drying. Its taste is aromatic, astringent, and bitterish. It should be gathered in the spring.

COMPOSITION.—The root has been the subject of repeated chemical experiment. Thus it was examined by Muehlenstedt,[2] Anjou,[3] Bouillon-

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[1] *Hist. Nat.* xxvi. 21, ed. Valp.

[2] Murray, *App. Med.* iii. 123.

[3] *Ibid.*

Lagrange,[1] Melandri and Moretti,[2] and Trommsdorff.[3] The latter chemist found the constituents of the dried root to be as follows:—*volatile oil* 0·039, *resin* 4, *tannin* soluble in alcohol and water 10, *tannin* insoluble in alcohol and ether, with traces of *chlorides*, 31, *gum* 15·8, *bassorin* 9·2, *ligneous fibre* 30 [excess 0·039].

PHYSIOLOGICAL EFFECTS.—Aromatic, tonic, and astringent.

USES.—Scarcely employed as a medicine in this country. [The root was formerly introduced into the Materia Medica of the Dublin College. In the last edition of the Pharmacopœia it is not mentioned.—ED.] It has been used in chronic diarrhœa and dysentery, leucorrhœa, chronic hemorrhages, and intermittents. It is put into ale, to communicate an agreeable clove-like flavour, and to prevent the liquor turning sour. Infused in wine it has been used as a stomachic.

ADMINISTRATION.—Dose ʒss. to ʒj., in powder or decoction, three or four times a day.

ESSENTIA RADICIS GEI. *Pharm. Norveg.; Tincture of Geum or Avens Root.*—Take of Avens Root coarsely powdered, one part: of Rectified Spirit, five parts. To be digested for half an hour in an alembic or other appropriate vessel, which will collect the condensed alcoholic vapour. When cold, the mass to be strained and pressed, and a sufficient quantity of Rectified spirit added to make up five parts of the Essence or Tincture.

274. POTENTILLA TORMENTILLA, *Sibthorp, L.*—COMMON TORMENTIL, OR SEPTFOIL.

Tormentilla officinalis, *Smith, D.*—Tormentilla erecta, *Linn.*

Sex. Syst. Icosandria Polygynia.

(Rhizoma, *L.*)

HISTORY.—Sprengel[4] considers this plant to be the πεντάφυλλον of Hippocrates, Theophrastus, and Dioscorides. But Sibthorp[5] considers the latter plant to have been the *Potentilla reptans*.

BOTANY. **Gen. Char.**—Tube of the *calyx* concave; limb 4- or 5-cleft, externally 4- or 5-bracteolate. *Petals* 4 or 5. *Stamens* numerous. *Carpels* numerous. *Style* lateral. *Receptacle* procumbent, persistent, juiceless, capitate. *Seed* appended.—*Herbs* or *under shrubs*. *Leaves* compound. *Stipules* adnate to the petioles. *Flowers* white, yellow, rarely red (De Cand.)

Sp. Char.—Multiform, hairy. *Root* tuberous. *Stem* ascending, dichotomous. *Leaves* ternate-palmatisect, the caulinar ones sessile; lobes obovate-wedge-shaped, more or less deeply teethed. *Stipules* 0- or 3-toothed. *Flowers* axillary, solitary, with long peduncles. *Bracts* palmate-incised. Segments of the *calyx* lanceolate-linear, as long as the co-

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[1] *Ann. de Chim.* liv. 287.

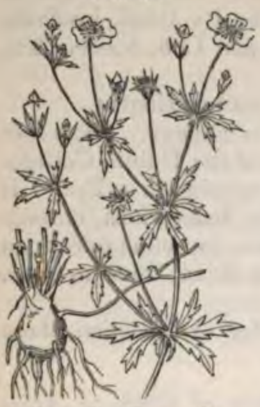
[2] *Bull. de Pharm.* ii. 368.

[3] Pfaff, *Mat. Med.* vi. 255.

[4] *Hist. Rei Herb.* i. 43, 93, and 176.

[5] *Prodr. Fl. Græcæ*, i. 352.

Fig. 51.



Potentilla Tormentilla.

rolla. *Carpels* rugose. *Receptacles* villose (De Cand.)

Stems weak, slender, often procumbent, branched. *Leaves* dark-green, somewhat hairy, especially the veins. *Flowers* bright-yellow.

Hab.—Indigenous; growing on barren pastures, heaths, and bushy places.

Description.—The root (*radix tormentillæ*) is large, compared with the size of the plant. Its external form is very irregular: sometimes it is more or less cylindrical, at others tuberculated and knobby. Its colour externally is dark red-brown, internally flesh-red or brownish. Its taste is astringent. Its watery infusion is coloured blackish-green (*tannate of iron*) by the sesquichloride of iron. A solution of gelatine causes a precipitate (*tannate of gelatine*) in it. By iodine, starch is detected in the root.

Composition.—Neumann[1] and Pfaff[2] submitted tormentilla root to a chemical investigation. Meissner[3] made an analysis of it, and found the constituents to be as follows:—*volatile oil* a trace, *tannin* 17·4, *colouring matter* 18·05, *ditto* altered 2·57, *resin* 0·42, *cerin* 0·51, *myricin* 0·20, *gummy extractive* 4·32, *gum* (pectin?) 28·20, *extractive* 7·70, *woody fibre* 15·0, and *water* 6·45 (excess 0·82).

Physiological Effects.—Astringent and tonic.

Uses.—Employed in chronic diarrhœa and dysentery, passive hemorrhages, and intermittents. The decoction is also used as an astringent wash and injection; as in flabby ulcers, and leucorrhœa. In the dysenteries of cattle it is reputed efficacious. In the Feroe and Orkney islands it is used to tan leather; in Lapland as a red dye.

Administration.—Dose ʒss. to ʒj., in powder or decoction, three or four times a day.

DECOCTUM TORMENTILLÆ, L.; *Decoction of Tormentilla.* (Tormentil, bruised, ℥ij.; Distilled Water, Oiss. Boil down to a pint, and strain).—Astringent and tonic. Used internally in chronic diarrhœa.—Dose, f℥j. to f℥ij. Sometimes employed as an injection in leucorrhœa.

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[1] *Works*, by Lewis, p. 362.

[2] *Mat. Med.* ii. 210.

[3] Gmelin, *Handb. d. Chem.* ii. 1269–70.

TRIBE IV. ROSEÆ.

275. ROSA CANINA, *Linn. L. E.*—COMMON DOG-ROSE.

Sex. Syst. Icosandria Polygynia.

(Fructus recens, *L.*—Hip of R. canina, and of several allied species, deprived of the carpels, *E.*—Fructus, *D.*)

HISTORY.—The κυνόροδον, or *Dog-Rose* of Hippocrates,[1] is, perhaps, *Rosa canina*, Linn., which, according to Sibthorp,[2] is a native of Greece. Pliny[3] speaks of *Rosa sylvestris*, which he says is called *cynorrhodon* (i. e. *Dog-rose*); but as he describes the *sponge* as growing on it, he probably referred to *Rosa rubiginosa* (*Sweet Briar*, or *Eglantine*), on which it is more frequently found than on any other species.

BOTANY.—**Gen. Char.**—Apex of the tube of the *calyx* contracted, the limb 5-parted; segments during æstivation somewhat spirally imbricated at the apex, often pinnatisect. *Petals* 5. *Stamens* numerous. *Carpels* many, inserted on the calyx, subsequently baccate, inclosed within the calyx, dry, indehiscent, somewhat crustaceous, bearing the style on the inner side. *Styles* exserted from the narrowed tube of the calyx, free or aggregated into a columnar style. *Seed* in an akenium, solitary, exalbuminous, inverted; *embryo* straight: *cotyledons* flat.—*Shrubs* or small *trees*. *Leaves* pinnate, with an odd one; leaflets serrate. *Stipules* adnate to the petiole (De Cand.)

Sp. Char.—*Prickles* uniform, hooked. *Leaves* naked or slightly hairy; their disk eglandulose. *Calyx-segments* fully pinnate, deciduous. *Styles* not united. *Shoots* assurgent (Hooker).

The British roses answering to these characters are subdivided by Hooker (*British Flora*) as follows:—

α. *R. canina*, Woods, Smith. *Leaflets* carinate; serratures simple.

β. *R. sarmentacea*, Woods, Smith; *R. canina*, Curtis. *Leaflets* naked, carinate; serratures compound.

γ. *R. surculosa*, Woods; *R. canina* β, Smith. *Leaflets* naked, flat; serratures simple.

δ. *R. dumetorum*, Woods, Smith. *Leaflets* more or less hairy, flat.

ε. *R. Fosteri*, Smith; *R. collina*, Woods. *Leaflets* more or less hairy, not flat.

De Candolle[4] admits no less than nineteen varieties of *R. canina*, Linn.

Ramification variable in denseness. *Shoots* more or less arched or erect, according to the vigour of the plant. *Prickles* not very numerous, hooked in various degrees, and compressed; their base considerably dilated. *Leaflets* variable in width; their serratures, although scarcely compound, except in β, are mostly irregular in size. *Bracts* variable in size. *Peduncle* and *calyx-tube* commonly naked; their setæ, when present, feeble, and not numerous; *calyx-segments* free from glands, or more or less copiously fringed with them. *Styles* hairy. *Fruit* coral-red, or more scarlet [usually oblong, elliptical or ovate, rarely somewhat globose], soft and pulpy when ripe, with a pleasant somewhat acid taste (Hooker).

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[1] *Opera*, p. 587, ed. Fœs.

[2] *Prod. Fl. Græc.* i. 349.

[3] *Hist. Nat.* lib. xxv. cap. 6, ed. Valp.

[4] *Prodr.* ii. 613.

Hab.—Indigenous. Thickets, hedges, &c.; very common. Flowers in June and July. Perennial.

DESCRIPTION.—The fruit used in medicine under the name of the *hip* or *hep* (*fructus rosæ caninæ* seu *f. cynosbati*), is oval, composed externally of the persistent calyx, whose sides have become thick, fleshy, beautifully red, shining; and internally, of numerous, hard, hairy akenia (commonly called seeds, but which, in fact, are the carpels, or real fruits), containing each an exalbuminous seed. The pulp or fleshy matter of the persistent calyx is sweet, acidulous, and pleasant to the taste, especially when mellowed by the frost. The hairs surrounding the akenia act as mechanical irritants, like the hairs of the pods of the cowhage, and when swallowed are apt to occasion gastric uneasiness, vomiting, and pruritus about the anus.

COMPOSITION.—According to Bilz,[1] 100 parts of the dried ripe fruit, deprived of akenia and hairs, consist of the following substances:—*volatile oil* a trace, *fatty oil* 0·065, *myricin* of the scale 0·05, *soft resin* of the pulp 1·419, *reddish-yellow hard resin* 0·463, *tannin* 0·260, *uncrystallisable sugar* 30·6, *gum* 25·0, *epidermis* 4·552, *medullary fibre* 14·0, *citric acid* 2·95, *malic acid* 7·776, *citrates, malates, mineral salts, water* (and *loss*) 12·865.

PHYSIOLOGICAL EFFECTS AND USES.—The pulp is nutritive, and slightly refrigerant and astringent. It is only employed in medicine in the preparation of a *conserve*.

CONFECTIO ROSÆ CANINÆ, L.; *Conserva Rosæ Fructûs*, E.; *Conserva Cynosbati; Conserve of Dog-Rose; Conserve of Hips.* (Dog-Rose, lb. j.; Sugar, powdered, ℥xx. Beat up the rose with the sugar added by degrees until they become one mass, *L.*—Take any convenient quantity of Hips, carefully deprived of their carpels; beat them to a fine pulp, adding, gradually, thrice their weight of white sugar, *E.*)—In the preparation of this conserve the akenia or carpels (commonly termed seeds), with their hairs, must be carefully separated, on account of the irritation they are apt to occasion (see above)—It is probable that the fruit of several varieties (or species?) are employed indiscriminately in the preparation of this conserve. The observation of Sir J. E. Smith deserves notice, that the fruits, casually gathered late in autumn, present a great diversity of flavour.[2] This conserve, being saccharine and acidulous, is nutritive and refrigerant. It is usually employed as a convenient and agreeable vehicle for other remedies; as for a pill-basis, or for the making of electuaries or linctuses. A very agreeable pectoral linctus containing almond oil, and, sometimes, syrup of poppies, is made with this conserve, acidulated with dilute sulphuric acid. A drawback to the use of this conserve is its tendency to candy or concrete by keeping.

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[1] Gmelin, *Handb. d. Chem.* ii. 1270.

[2] *Eng. Fl.* ii. 395.

276. ROSA GALLICA, *Linn. L. E. D.*—FRENCH OR RED ROSE.

Sex. Syst. Icosandria Polygynia.
(Petalum nondum explicatum recens et exsiccatum, *L. D.*—Petals, *E.*)

HISTORY.—Perhaps our red rose may be the *Rosa Milesia* of Pliny,[1] the colour of which, he says, was very warm [*ardentissimus*], and whose petals did not exceed twelve in number. The *Rosa Trachinia*, he adds, stands next to this, but is less red.

BOTANY. **Gen. Char.**—See *Rosa canina.*

Sp. Char.—*Prickles* unequal. *Stipules* narrow, straggling at the point. *Leaflets* 5 to 7, coriaceous, rigid, ovate, or lanceolate, deflexed. *Flower-bud* ovate-globose. *Sepals* spreading during flowering. *Fruit* somewhat globose, very coriaceous. *Calyces* and *peduncles* more or less very finely glandulose-hispid, somewhat viscous (De Cand.)

A small *shrub*. Very variable in *form.*—De Candolle[2] admits twelve distinct varieties. Mr. G. Don[3] enumerates more than two hundred sorts cultivated by gardeners. And we are told[4] that the Dutch cultivators have more than five hundred varieties. The variety cultivated at Mitcham, where it is called the *Damask Rose*, appears to me to be *R. gallica* var. δ *officinalis*, De Candolle.

Hab.—South of Europe. Common in gardens. For medicinal purposes cultivated at Mitcham.

DESCRIPTION.—The dried petals of the unexpanded flowers, deprived of their white claws or heels (*ungues*), constitute the *red-rose leaves* (*flores rosæ rubræ*) of the shops. The flower-buds are brought to market when about the size of a large nutmeg. The calyx and claws being cut off, the petals are speedily dried. At Mitcham this is effected in a stove. Slow desiccation impairs both their astringency and colour. The petals of the buds are much more astringent than those of the full-blown flowers: hence they are preferred for medicinal use. When dried they are sifted to remove the stamens, and insects. 2,000 flowers yield about 100 lbs. of fresh, or 10 lbs. of dried petals. The dried petals have a velvety appearance: their colour is purplish-red; their odour, which is principally developed during desiccation, is agreeable: their taste is bitterish and astringent. As they lose their fine colour when exposed to light and air, and are apt to become mouldy or worm-eaten, they should be carefully preserved in bottles or canisters.

COMPOSITION.—The petals were analysed by Cartier,[5] who found the following substances:—*volatile oil, colouring matter, tannin, gallic acid, fatty matter, albumen, soluble potash salts, calcareous insoluble salts, silica,* and *oxide of iron.*

1. ASTRINGENT MATTER (*tannic and gallic acids*).—The presence of astringent matter is shown by the very dark colour (*tannate and gallate of iron*) produced in an

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[1] *Hist. Nat.* lib. xxi. cap. 10, ed. Valp.
[2] *Prodr.* ii. 603.
[3] *System of Gardening.*
[4] *Journ. de Pharm.* xii. 443.
[5] *Ibid.* vii.

infusion of red roses by the ferruginous salts, and by the slight precipitate (*tannate of gelatine*) caused on the addition of a solution of gelatine.

2. COLOURING MATTER.—Has not yet been isolated. A watery infusion of red rose leaves has a pale yellowish-red colour: the alcoholic tincture is also pale-coloured. On the addition of sulphuric acid an intense bright red colour is produced (*sulphate of the colouring matter*). Alkalies communicate a greenish tint to the watery infusion (probably by neutralising the free acid, to which, with the colouring matter, the red tint is owing).[1] Sulphurous acid destroys the colour of the infusion of roses (*sulphite of colouring matter?*); but on the addition of sulphuric acid the intense bright red (*sulphate of ditto*) is produced, with an evolution of sulphurous acid gas. Dr. Clarke and others had supposed that the red colour was owing to iron; but both Gay-Lussac and Cartier found more iron in white than in red roses. Thus 1000 grains of the white rose yielded the latter chemist 99 grains of ashes containing 12·4 of iron; while the like quantity of the red rose yielded 50 grains of ashes, in which were only four grains of oxide of iron.

PHYSIOLOGICAL FFFECTS AND USES.—Red rose leaves are mild astringents and tonics; but their power is exceedingly slight, and scarcely deserves notice. By the Arabian physicians, Avicenna and Mesue, as well as by more recent writers, Riverius, Krüger, and others, conserve of roses was esteemed a valuable remedy in phthisis.[2] At the present time red rose leaves are principally used for their colour and flavour. They yield several officinal preparations, which are valuable as forming elegant vehicles for the exhibition of other more active medicines. The full-blown flowers are said to be as laxative as those of *R. centifolia.* "Poterius relates, that he found a drachm of powdered red roses occasion three or four stools, and this not in a few instances, but constantly, in an extensive practice for several years."[3]

1. **INFUSUM ROSÆ COMPOSITUM**, L.; *Infusum Rosæ*, E.; *Infusum Rosæ acidum*, D.; *Infusion of Roses.* (Petals of the Red or Gallic Rose, dried, ʒiij. [ʒij. *D.*]; Diluted Sulphuric Acid, fʒiss.; Sugar [pure, *E.*, ℥j.], ʒvj.; Boiling Water [distilled, *L.*], Oiss. Pour the Water upon the Rose petals previously pulled asunder; then mix in the Acid. Macerate for two hours [one hour, *D.*], and strain the liquor; lastly, add the sugar to it, *L.* Infuse the petals for one hour in the water, in a covered vessel, strain, and add the acid. The product should measure about eight ounces, *D.*—The *Edinburgh College* infuses the petals in the water for four hours, in a vessel of glass or porcelain, not glazed with lead; then add the acid, strain through linen or calico, and dissolve the sugar in the strained liquor.)—The lengthened maceration of six, or even four hours, is unnecessary. An hour, as recommended by the Dublin College, or perhaps even half an hour, is quite sufficient. Infusion of roses is a mild, but very agreeable, refrigerant and astringent, and is a very pleasant drink in febrile disorders, hemorrhages, diarrhœa, and colliquative sweats. It forms a very elegant vehicle for other medicines; as for saline purgatives (especially sulphate of magnesia, the unpleasant taste of which it serves greatly to cover), for disulphate of quina (which is dissolved in the water by the free sulphuric acid, which also serves to prevent the tannic acid of the roses precipitating the

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[1] [Paper dipped in this infusion serves as a test for alkalies and the salts of iron. It is turned green or greenish yellow by the alkalies, and blue-black by iron salts.—ED.]

[2] Murray, *App. Med.* iii. 168.

[3] Lewis, *Mat. Med.*

quina),[1] the mineral acids, bitter tinctures and infusions, alum, &c. It serves as a very useful gargle; for which purpose acids, nitre, alum, or tincture of capsicum, are usually conjoined. Of course the alkalies and the earths, as well as their carbonates, are incompatible with it; they neutralise the acid, and change the colour of the preparation to green or brownish green. Sulphate of iron communicates a deep olive colour, and after some hours causes a precipitate. The sulphuric acid of the infusion of roses decomposes and destroys the activity of the acetate of lead, by forming sulphate of lead. It is a common practice, however, though of course among ignorant practitioners only, to administer, in hemorrhages, a pill composed of acetate of lead and opium, and at the same time infusion of roses (?)[2] The dose of infusion of roses is f℥j. to f℥ij. Each f℥j. contains ♏ivss. of dilute sulphuric acid, which are nearly equivalent to three-sevenths of a minim of strong sulphuric acid.

[2. **CONFECTIO ROSÆ**, L. D.; *Conserva Rosæ*, E.; *Conserve of Red Roses*. (Petals of the Red Rose, lb. j.; Sugar, lb. iij. Beat the rose petals in a stone mortar; then, the sugar being added, beat them again until they are thoroughly incorporated, *L.*—Beat the petals of the Rosa Gallica to a pulp, gradually adding thrice their weight of white sugar, *E.* Dried petals of the Gallic Rose, ℥j.; Rose Water, f℥ij.; Refined Sugar, ℥iij. Macerate the petals in the rose water for two hours, add the sugar gradually, and beat them into a uniform mass. Or, take of fresh petals of the Gallic Rose, three ounces; Refined Sugar eight ounces; rub the petals in a mortar, then add the sugar gradually, and beat them together until they are intimately mixed, *D.*—The Dublin confection contains the largest quantity of rose leaves, and the London the least.)—This preparation is slightly astringent. It was formerly much esteemed in phthisis. Its principal use now is as a vehicle for the exhibition of other medicines. Thus it is a common pill-basis for calomel, disulphate of quina, &c. *Pilulæ hydrargyri* are prepared with it. Alone, or conjoined with the confection of dog rose, it forms the basis of some elegant pectoral linctuses or electuaries, containing almond oil, diluted sulphuric acid, or syrup of poppies. Over the confection of dog rose it has the advantage of having no tendency to candy. Furthermore, it does not ferment or become mouldy.—Dose, ʒj. to ʒij. or more.

[3. **MEL ROSÆ**, L. E.; *Honey of Roses*. (Dried Red Rose, ℥iv.; Boiling Distilled Water, ℥xxiv.; Honey. lb. v. Macerate the rose petals, first separated, in ℥xvj. of the water, for two hours; then lightly press with the hand and strain; what remains macerate again for a little time in the rest of the water, and pour off the liquor; to this add the half of the first infusion, and set aside the other half; then to the honey add the mixed liquors, and evaporate in a water-bath, so that the solution which was set aside being added, it may become of a proper consistency,

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[1] Mr. Squire says that sulphuric acid does not dissolve the tannate of quina, but that nitric acid does. [We do not find that either acid dissolves the tannate.—ED.]

[2] [Experience shows, however, that the alternation of doses of such pills and mixture every few hours is an effective mode of treating many forms of hemorrhage, especially hemoptysis. —ED.]

L.—The Edinburgh College directs the same weight of the petals of the rose and of honey. The petals are to be infused in the water for six hours, then strained and squeezed, mixed with the honey, and the liquid evaporated.)—ED.]—A mildly astringent and very agreeable preparation, principally employed in the diseases of children. It is used sometimes alone as a mild detergent in slight aphthous affections, or inflammatory conditions of the mouth and throat; or as an agreeable vehicle for the exhibition of other more powerful medicines. It is occasionally added to detergent or astringent gargles.—Dose, for children, ʒj.

[4. **SYRUPUS ROSÆ GALLICÆ,** E. D.; *Syrup of Roses.* (Dried Red Rose petals, ℥ij.; Boiling Water, Oj.; Pure Sugar, ℥xx. Proceed as for the Syrup of damask rose, *E.*—Take of petals of the Gallic Rose, dried, ℥ij.; Boiling Distilled Water, Oj.; Refined Sugar, in powder, as much as is sufficient. Boil the petals in the water in a glass or porcelain vessel, until their colour is completely extracted; strain by expression, and let the decoction stand until the sediment subsides; then, having decanted the supernatant liquor, add to it twice its weight of sugar, and dissolve with the aid of steam or water heat, *D.*)]—This syrup, though very slightly astringent, is principally valuable for its red colour, on account of which it is sometimes added to mixtures and electuaries (as the *Electuarium Catechu,* E.).

277. ROSA CENTIFOLIA, *Linn. L. E. D.*—THE HUNDRED-LEAVED OR CABBAGE ROSE.

Sex. Syst. Icosandria Polygynia.

(Petalum recens; Petala, *L.*—Petals; Volatile oil of the petals, *E.*)

HISTORY.—Theophrastus[1] speaks of a *Rosa centifolia* (Ῥοδον ἑκατονάφυλλα) which grow abundantly about Philippi. Herodotus[2] mentions a rose growing naturally in Macedonia, and which had sixty leaves, and more than ordinary fragrance. This perhaps was *R. centifolia.* Pliny[3] also notices the *R. centifolia.*

BOTANY. **Gen. Char.**—See *Rosa canina.*

Sp. Char.—*Prickles* nearly straight, scarcely dilated at the base. *Leaflets* 5 to 7, ovate, glandular and flaccid at the margin, hairy beneath. *Flower-buds* ovate, short. *Sepals* during flowering, spreading, not deflexed. *Fruit* ovate, somewhat pulpy. *Calyces* and *peduncles* glandulose-hispid, rigid, fragrant (De Cand.)

De Candolle admits seventeen distinct varieties. In gardens are found above eighty sorts. One of the best known of them is the *Moss Rose* (*R. Muscosa*). At Mitcham, the sort cultivated for medicinal purposes, under the name of the *Provins* or *Cabbage Rose,* appears to me to agree with the var. α *vulgaris* * *foliacea* of De Candolle. Its *leaflets* are oval or rounded oval. The larger *prickles* slightly falcate.

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[1] *Hist. Plant.* vi. 6.

[2] *Urania,* cxxxviii.

[3] *Hist. Nat.* lib. xxi. cap. 10, ed. Valp.

Hab.—Asia. Cultivated at Mitcham, and other places, for medicinal purposes.

DESCRIPTION.—The petals of the hundred-leaved rose (*flores rosæ centifoliæ* seu *pallidæ*) are commonly termed in the shops *Provins* or *Cabbage rose-leaves.* They should be gathered when the flowers are full-blown, and before the petals begin to fall. Their odour is strongest when they are of a fine pale red, and before they begin to fade. When freed from the calyx cups and stamens, they are to be dried in the air. Unlike the petals of *R. gallica,* desiccation diminishes their fragrance. Their odour is said to be singularly exalted by iodine.[1] Their taste is sweetish, though somewhat acidulous and bitter. To preserve rose leaves, they are frequently *pickled* or salted (*flores rosæ saliti*) like elder flowers.

COMPOSITION.—I am unacquainted with any analysis of the petals of the *Rosa centifolia.* The following, however, may be regarded as the ascertained constituents:—*volatile oil, gallic* (and tannic?) *acid, colouring matter, a saccharine matter* (sweet extractive of Pfaff), *woody fibre, mineral salts,* and *oxide of iron.*

1. VOLATILE OIL (see page 294).

2. LAXATIVE PRINCIPLE (*Sweet Extractive* of Pfaff).—The nature of the laxative principle of the hundred-leaved rose has scarcely been examined. Pfaff[2] declares it to be sweet extractive.

PHYSIOLOGICAL EFFECTS AND USES.—The petals are mildly laxative, and are employed, on this account, in the form of syrup (see *Syrupus Rosæ*).

On account of its delightful fragrancy, this rose is in common use for nosegays and scent-bags, and is employed for the distillation of *rose water.* Its odorous emanations, however, are not always innocuous; but on some persons have acted as a poison[3], causing symptoms which, for the most part, are those indicating a disordered condition of the cerebro-spinal system—such as headache, fainting, and hysterical symptoms; and occasionally giving rise to local irritation, manifested by sneezing and inflammation of the eyes.

1. SYRUPUS ROSÆ, L.; *Syrupus Rosæ centifoliæ,* E; *Syrup of Roses; Syrup of Damask Rose.* Rose Petals, dried, ℥vij. [lb. j. *E.*]; Sugar [pure, *E.*], lb. vj. [lb. iij. *E.*]; Boiling Water, Oiij. [Rectified Spirit, ℥vss. *L.*] Macerate the Rose Petals in the Water for twelve hours, and strain. Evaporate the strained liquor, in a water-bath, to Oij. Then add the sugar [dissolve with the aid of heat, *E.*] and strain: lastly, mix in the spirit, *L.*—Gently laxative. Used only for young children. Dose, fʒij. to f℥j. Its red colour is heightened by acids; alkalies change it to green or yellow.

2. AQUA ROSÆ, L. E. D.; *Rose Water.* (Petals of Rosa centifolia, lb. x.; [Rectified Spirit, f℥iij. *E.*]; Water, *Cong.* ij. Let a gallon distil.—" The petals should be preferred when fresh; but it also answers well to use those which have been preserved, by beating them with twice their weight of chloride of sodium," *E.*) The *Dublin College* directs the Rose Water to be prepared by agitating ♏xx. of essential oil of Roses with *Cong.* ss. of distilled water, and filtering through paper.—Rose water is prepared both from fresh and pickled rose leaves, but of course the former are preferable. During its distillation a solid volatile oil comes over with it and floats on the water in the receiver. To prevent the water becoming sour, it should be preserved in well-corked bottles, kept in cool places. Spirit of wine ought not to be mixed with it, for if a sufficient quantity be added to preserve the water, it renders it unfit for some medicinal purposes. Rose water is employed, on account of its odour only, as an addition to lotions and collyria.

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[1] Chereau, *Journ. de Pharm.* xii. 442.

[2] *Mat. Med.* Bd. iv. S. 277.

[3] See Murray, *App. Med.* iii. 160; Orfila, *Toxicol. Gén.*

3. **OLEUM ROSÆ,** E.; *Attar* or *Otto of Roses.*—Obtained in the East, by distilling roses with water. The attar concretes and floats on the distilled water when cold.[1] In Northern India, rose water and attar are distilled from *R. damascena.*[2] The precise species of rose used at Ghazepoor, in Hindostan, where the attar is extensively distilled, as well as at Shiraz, in Persia, has not been satisfactorily ascertained. At the latter place a rose with white flowers is said to be used.[3] Is it *R. moschata?* In the manufacture of rose water in England, from *R. centifolia,* a crystalline volatile oil, with the odour of the attar, is frequently obtained (*English attar of roses*). Polier says, that to procure something less than three drachms of attar from 100 lbs. of rose leaves, in India, the season must be very favourable, and the operation carefully performed. Jackson states, that from one lac of roses it is generally calculated that 180 grains, or one tolah of attar, can be procured. Heber[4] says, 20,000 roses yield attar equal in weight to that of a rupee. According to Donold Monro[5] the attar is procured without distillation, merely by macerating the petals in water. But Trommsdorff[6] tried the method, and failed to procure any oil. [It is, however, certain that, in India, attar is occasionally obtained by exposing the rose-leaves in water to the sun, when the oil floats out. Landerer states also, that he has been informed by a person who was for some years engaged in the manufacture, that attar is obtained at Damascus, and other parts of Asia Minor, by dry distillation of the rose at the temperature of a salt-water bath.[7]—Ed.]

Attar of roses is imported from Constantinople and Smyrna. The duty on it is 1s. 4d. per lb. In 1838, 973 lbs.; in 1839, 745 lbs. paid duty.[8]

At temperatures below 80° F. attar of roses is a crystalline solid. It is usually almost colourless; but Polier says, colour is no criterion of its goodness, quality, or country. Undiluted, its odour is somewhat too powerful to be agreeable; but when properly diffused through the air or some liquid, it is most delicious. It is combustible, and its vapour with oxygen forms an explosive mixture. It fuses at between 84° F. and 86° F. Its sp. gr. at 90° F. is 0·832; water at 60° F. being 1·0.[1] At 57° F. 1000 parts of alcohol (sp. gr. 0·806) dissolve 7 parts, and at 72° F. 33 parts of attar.

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[1] Polier, *Asiat. Research.* i. 332; Jackson, *Ed. New Phil. Journ.* xxviii. 326.
[2] Royle, *Illustr.* 203.
[3] Fée, *Hist. Nat. Pharm.* ii. 127.
[4] *Narrative,* i. 266.
[5] *Treat. on Med. and Pharm. Chym.* ii. 311.
[6] Martins, *Pharmacogn.*
[7] *Pharm. Journ.* xi. 105.
[8] *Trade List.*

Attar of roses has been analysed by Saussure and Blanchet, but their results do not accord.

Blanchet's Analysis.

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	23	138	74·59
Hydrogen	23	23	12·43
Oxygen	3	24	12·98
Attar of Roses	1	185	100·00

Saussure's Analysis.

	Per Cent.
Carbon	82·053
Hydrogen	13·124
Oxygen	3·949
Nitrogen	0·874
	100·000

Sandal-wood oil, oil of rhodium, some of the fixed oils, and spermaceti, have been said to be occasionally employed for adulterating attar of roses; but as far as my observation extends, the attar found in the shops of London is very pure.

Attar of roses consists of two volatile oils; one solid, the other liquid, at ordinary temperatures, in the proportion of about one part of the first to two parts of the second. To separate them the attar is to be frozen and compressed between folds of blotting paper, which absorbs the liquid and leaves the solid oil; or they may be separated by alcohol (of sp. gr. 0·8). which dissolves the liquid, but takes up scarcely any thing of the solid oil.

α. Solid Oil of Roses (*Rose Camphor; Stéaroptène of Oil of Roses*).—Occurs in crystalline plates, fusible at about 95° F. It is composed, according to Saussure, of *carbon* 86·743, and *hydrogen* 14·889; or an equal number of atoms of carbon and hydrogen. Blanchet states its composition to be, *carbon* 85·86, *hydrogen* 14·46. [The solid portion is insoluble in alcohol, but may be purified by solution in ether. In constitution it is isomeric with oil of turpentine, being represented by CH or some multiple of it.—ED.]

β. Liquid Oil of Roses (*Eléoptène of Oil of Roses*).—This oil has not been accurately examined. From Saussure's analysis of the ordinary attar and of its stéaroptène, it would appear to contain oxygen and nitrogen, in addition to carbon and hydrogen. By calculation the proportions appear to be, *carbon* 80·56, *hydrogen* 12·42, *oxygen* 3·92, *nitrogen* 1·3.[2] The presence of nitrogen has not been confirmed by the researches of other chemists.

Attar of roses is employed for scenting only. In the shops various perfumes are sold which owe their odour to the attar. Thus *oil for the hair*, sold as *huile antique rouge à la rose*, is merely olive oil coloured by alkanet, and scented with the attar. *Milk of roses* also contains the attar. Several compound scents owe a portion of their fragrance to this oil; as *lavender water*. The Edinburgh College has very properly, as I conceive, introduced this oil into the Pharmacopœia; for, as medicines frequently require to be perfumed, I cannot conceive why the most delicious perfume should be excluded from the Materia Medica. It may be employed as an addition to unguents and spirit washes.

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[1] Saussure, *Ann. Chim. et Phys.* xiii. 337.

[2] Dumas, *Traité de Chim.* i. 494.

OTHER MEDICINAL ROSACEÆ.

1. BRAYERA ANTHELMINTICA (*Kousso*).

HISTORY. — The flowers of this plant under the name of *Kosso* or *Kousso* have been used in Abyssinia as an anthelmintic for more than two centuries; for Leutholf (Ludolfi, *Historia Æthiopica*, lib. i., cap. ix., sect. 31, 1681) says that "N. Godingus[1] praises another tree as being very efficacious against *lumbrici*, which are produced by the use of raw meat. But the Abyssinians purge themselves every month with the fruit of this tree, and thus," he says, "destroy these worms." There can be little doubt, I conceive, but that this passage refers to the *kosso*. Bruce, in his *Travels to Discover the Source of the Nile, from* 1768 *to* 1773 (vol. v. p. 73.), published at London in 1790, mentions this medicine, which he calls *cusso*, and proposes to name the tree *Banksia Abyssinica*, after Sir Joseph Banks, the then President of the Royal Society. But the younger Linnæus, in the *Supplementum Plantarum*, published at Brunswick in 1781, had already appropriated the name of *Banksia* to a New Holland genus of proteaceous plants, and he has been followed by all succeeding botanists; so that it is obvious that Bruce's proposed botanical name for the *kosso* cannot be adopted.

Bruce gave a very good popular account of *kosso* accompanied by what he justly terms "a true and exact" figure of the plant. I have compared his figures with a specimen of the plant collected in Abyssinia by Schimper, and contained in the herbarium of my friend Mr. N. B. Ward, and with the commercial flowers, and find that they are fair representations of the plant. Bruce states that the Abyssinians evacuate once a month "a large quantity of worms; these are not the tape-worm, or those that trouble children, but they are the sort of worm called ascarides." This statement agrees with that of Godingus just quoted; but it does not accord with the observations of other travellers, who tell us that the worms with which the Abyssinians are troubled, and for which they employ the *kosso*, is the tape-worm. The accuracy of this latter statement has been proved by Dr. Hodgkin (*Medical Times*, October 26th, 1844, p. 74) who gave oil of turpentine to an Abyssinian in the service of Dr. Beke, and thereby expelled a Tænia solium — the same kind of tape-worm which prevails in England, and which is understood to prevail at the Cape of Good Hope.

In the *Encyclopédie Méthodique* (*Botanique*, Supplem. tom. ii. p. 423. 1811), Lamarck has described the *Cusso d'Abyssinie*, which he named after Dr. C. G. Hodgson, a professor at Königsberg, the *Hagenia Abyssinica*. He says the tree was discovered by Brown — but I presume that this is a typographical error, and that for "Brown" should be read "Bruce;" for the figures of the plant given by Lamarck (pl. 311) are obviously copied from those of Bruce, though he does not refer to this distinguished traveller as his authority. It is remarkable that Lamarck's proposed generic name (*Hagenia*) has been applied by the late Professor Eschweiler (*Systema Lichenum*, 1824) to a proposed genus of lichens usually included in that of Parmelia; and by Mönch (*Methodus*, 1794) to a caryophyllaceous plant now regarded as a species of Gypsophila. Wildenow (*Species Plantarum*), and Sprengel (*Syst. Veget.* ii. 220. 1825) have each adopted Lamarck's name (*Hagenia Abyssinica*) for *kosso*.

Dr. Brayer, a French physician, who resided for a considerable time at Constantinople, and who had witnessed the valuable anthelmintic properties of *kosso*, and had himself successfully employed this remedy, sent, on his return to Paris, in 1823, some fragments of the male flowers to the late celebrated Prussian botanist, Kunth, who ascertained that the plant which yielded them formed a new genus, near to, but distinct from, that of Agrimonia.[2] To this genus Kunth gave the name of *Brayera*, after the physician who sent him the flowers, and the species he called *B. anthelmintica*. This generic name has been adopted in the systematic works both of De Candolle (*Prodromus*, vol. ii. p. 588) and Endlicher (*Genera Plantarum*, 6395). Kunth does not appear to have been aware either of Bruce's notice of *kosso*, or that Lamarck had previously given to this genus the name of *Hagenia*, otherwise, doubtless, he would have referred to them, and have adopted this designation. Dr. Brayer published a little pamphlet (*Notice sur une Nouvelle Plante de la Famille des Rosacées*, Paris, 1823, 8 pages) on this medicine, but which I have not been able to get a sight of; the reply to my inquiries for it at Paris being that it was out of print. According to the information furnished by Dr. Brayer, it appears that *kosso* is carried by the caravans to Egypt, and from thence finds its way to Constantinople.[1] The identity of the genera *Hagenia* and *Brayera* was first recognised by Fresenius (*Museum Senkenbergianum*, vol. ii. p. 162, 1837.)

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[1] "*De Abyssinorum rebus*, lib. i. cap. 2, 8vo. Lyon, 1615."

[2] In the first volume, p. 470, of the *Mémoires de l'Académie Royale de Medicine*, it is erroneously stated that *kosso* is the *Agrimonia orientalis* of Tournefort, who saw it in Abyssinia.

In 1839, Buchner (*Repertorium*, 2te Reihe, Bd. xviii. S. 367) gave a notice of three Abyssinian remedies which he had received from Engelmann. One of these was the *kosso* (called *koso*), which was stated to be the flowers of the *Bracera* [Brayera] *anthelmintica.* In 1840, Wittstein (Buchner's *Repertorium*, 2te Reihe, Bd. xxi. p. 24) published an analysis of *kosso*, which he calls *Bracera anthelmintica*. Riecke's *Die neuern Arzneimittel*, published in 1840, contains a notice of the *Brayera anthelmintica* by Dr. Plieninger, who obtained his information respecting it from some missionaries returned from Abyssinia; and the same notice includes some botanical and pharmacological account of this medicine by Dr. Kurr. In 1841, Dr. Aubert, who had spent some time in Abyssinia, read a *Mémoire sur les Substances Anthelmintiques usitées en Abyssinie*, before the Académie Royale de Médecine, Paris, and which was published in the Memoirs of the Academy for that year. His account of the anthelmintic virtues of the *kosso* confirms the statements of preceding writers. A very interesting Report on his memoir was drawn up by Mérat, and published in the *Bulletin de l'Académie Royale de Médecine*, tom. vi. p. 492, 1840–41. M. Rochet d'Hericourt, in his *Second Voyage sur les Deux Rives de la Mer Rouge dans le Pays des Adels et le Royaume de Choa*, published at Paris in 1846, gives a very brief notice of the *kosso*, with a lithograph of the flowers and leaves. This traveller is the present holder of the entire European stock (about 1400 lbs.) of *kosso*. Drs. R. Quartin-Dillon and A. Petit, the naturalists of the French Expedition to Abyssinia in the years 1838–43, collected the kosso; of which a botanical description has been published by A. Richard, in the *Tentamen Floræ Abyssinicæ*, which forms the fourth volume of the *Voyage en Abyssinie*, edited by M. Th. Lefebvre. The forty-eighth plate of the "Botanique" of this "Voyage" contains an excellent figure of the plant, with dissections of the flower.

NATIVE NAMES.—My friend Dr. Beke, the well-known Abyssinian traveller, has given the following note respecting the native names for this remedy:—"The tree, of the flowers of which you have a sample, is called in the Amharic language *kosso*,[2] and in that of Tigre, *hhàbbe*.[3] In the Gafat language it is styled *kossish*, and in the Gonga, *kosbo*;[4] in the Agau of Waag, *sika;* in that of Agau-mider, *shinei;* and in Falasha, *sakikuna;* whilst in Galla, its name is *bèti*. In the countries further to the south, it has other names[5], which, however, I have not collected in my vocabularies of the languages of those countries. But it is best known in Abyssinia and Europe by its Amharic designation, *kosso*." Dr. Beke further observes, that "the tape-worm, for which the kosso flowers are a remedy, is known in the languages of Amhara and Tigre by the same names respectively as the medicine itself, viz. *kosso* and *hhàbbe*. So, too, in the Gafat and Ginga, in which respectively both are called *kóssish* and *kósbo*. In

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Now, in the first place, Tournefort never was in Abyssinia; and secondly, the *A. orientalis* (*A. repens*, Linn.) is a creeping herb, whereas the *kosso* is a large tree!

[1] In the *Journ. de Pharmacie*, t. ix. p. 160, 1823, is an *Extrait du Bulletin de la Société Philomathique*, 1822, containing a notice of Dr. Brayer's observations respecting *kosso*, and of Kunth's determination of the plant.

[2] This word is variously spelt by different writers, *cusso*, *cosso*, *cousso*, *coso*, *koso*, *kosso*, and *kousso*. Dr. Aubert says it should be pronounced (in French) *cousso*.

[3] According to Dr. Plieninger, who obtained his information from the Abyssinian missionaries, the Tigre name is *hepah*. Wittstein writes it *habi*.

[4] Written *cobso* by some persons.

[5] "Dr. Brayer gives *cotz* or *cabotz*, as vernacular names: according to Dr. Aubert (*Bullet. de l'Acad. Royale*) these names are erroneous."

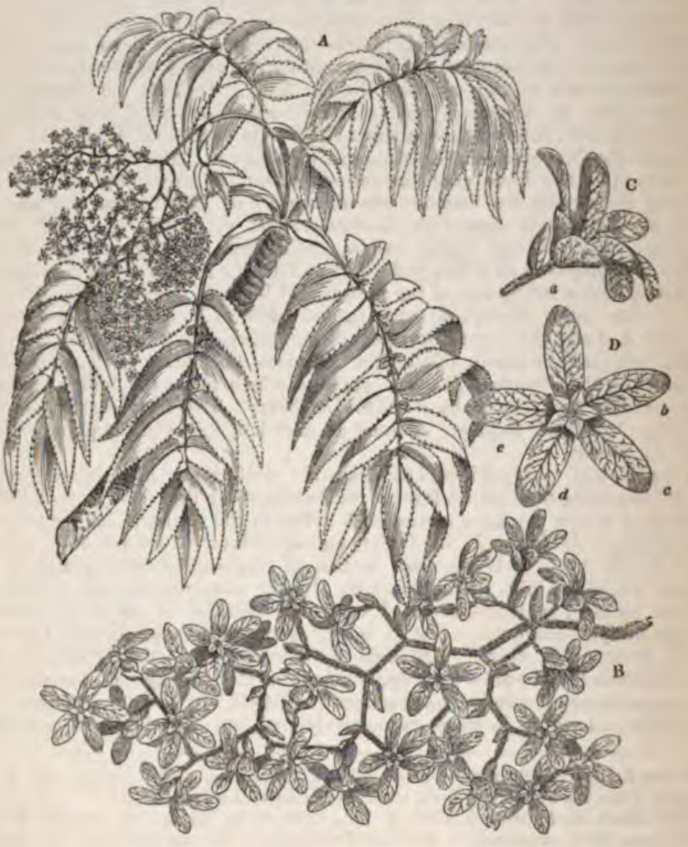
the Waag-Agau, likewise, the name *sika* is the same for both; but in the dialect of Agau-mider the worm is called *turo*, and, in the Falasha, *saka*; whilst in the Galla, it is *minui*."

BOTANY.—The first accurate botanical description of the flowers of *kosso* was given by Kunth, whose account has been adopted in De Candolle's *Prodromus*. Kunth, however, was acquainted with the male flowers only. The most recent systematic notice of genus Brayera is that of Endlicher, which I shall adopt.

BRAYERA, Kunth, in *Brayer Notice*, in 8vo. 1824, Paris; *Dict. Class. Hist. Nat.* vol. ii. p. 501., cum icone. DC. *Prodr.* ii. 588. Meisner, *Gen.* 103 (73). Fresenius in *Mus. Senkerb.* ii. 162.; Endlicher, *Gen. Plant.*, p. 1248. 6395; HAGENIA, Lamarck, *Encycl. Méth. Bot.* Suppl. t. ii. p. 423; Willdenow, *Sp. Pl.* ii. 331. CUSSO, BANKESIA, Bruce's *Travels*, vol. v. p. 73.

Calyx, with the tube bitracteolate at the base, turbinate; throat constricted internally

FIG. 52.



Brayera anthelmintica, Kunth.

A. Flowering branch.
B. Bunch of female flowers.
C. Flower seen laterally.
D. Female flower.

a, *b*, *c*, *d*, *e*, the five outer segments of the calyx.

by a membranous ring; limb 10-partite; the segments in two series, the five outer ones much larger, oblong-lanceolate, obtuse, reticulate-veined, stellately patent, the five inner ones alternate, smaller, spathulate. *Petals* 5, inserted in the throat of the calyx, small, linear. *Stamens* from 15 to 20, inserted along with the petals. *Filaments* free, unequal in length. *Anthers* bilocular, dehiscing longitudinally. *Carpella* 2, placed at the bottom of the calyx, free, unilocular, containing one or two pendulous ovules. *Styles* terminal, exserted from the throat of the calyx, thickened upwards. *Stigmas* subpeltate-dilated, crenato-oblong.

NAT. ORD.—ROSACEÆ, Jussieu. De Candolle places it in Tribe v. *Dryadeæ*. Endlicher, in his suborder, *Spiræaceæ*.

BRAYERA ANTHELMINTICA, Kunth, l. c.; DC. l. c.; A. Richard, Tentamen, Floræ Abyssinicæ; *Hagenia, Abyssinica*, Lamarck, l. c.; *Cusso, Bankesia Abyssinica*, Bruce, l. c.

The only species.

An Abyssinian tree, twenty feet high. It grows in Tigre, Agame, and Shoa, and is cultivated everywhere. Branches round, rusty, tomentose-villose, marked by the annular cicatrices of the fallen leaves. *Leaves* crowded, alternate, interruptedly, imparipinnate and sheathing at the base. Leaflets oblong, or elliptical lanceolate, acute, serrate, villose at the margin and on the nerves of the under surface. Stipules adnate to the petiole, which is dilated at the base and amplexicaul. *Flowers* diœcious, small, greenish, and becoming purple; repeatedly dichotomous; the pedicles with an ovate bract at the base. The so-called male flowers may be regarded as hermaphrodite flowers, inasmuch as the carpels are well developed. The female flowers are somewhat different in their structure. The outer segments of the *calyx* are much more developed than in the female flowers; and are four or five times larger than those of the inner row, and are placed somewhat below them; the petals are entirely wanting; the stamina are rudimentary and sterile. The ripe fruits are unknown.

Dr. Beke writes that the tree is "found throughout the entire table land of North-eastern Abyssinia, but appears to require an elevation of upwards of six thousand (perhaps of seven thousand) feet for its growth. Where I found it most luxuriant was in the vicinity of the source of the river Abai (Bruce's Nile), at an elevation of close upon nine thousand feet. Tigre, the Northern portion of Abyssinia, being, on the whole, of lower elevation than the rest of that country, the tree is only found there in a few places." Bruce describes the *flowers* as being of a greenish colour, tinged with purple; and, when fully blown, of a deep red or purple. The *petals*, he says, are *white*.

PREPARATION.—Mr. Johnston states that the kosso is gathered for medicinal purposes before the seeds are quite ripe, whilst still a number of florets remain unchanged. The bunches are suspended in the sun to dry, and if not required for immediate use, are deposited in a jar.

PHARMACOGRAPHY.—I have seen only one package of *kosso* (*flores brayeræ anthelminticæ*); this was kindly opened in my presence by M. Simond, of the firm of Caylits Simond, and Co., the agents of M. Rochet d'Hericourt. It was was a deal box, containing about 30 lbs. of the dried flowers, wrapped up in a large skin of red leather. On removing the lid of the box and untying the leather package, the fragrant or balsamic odour of the dried flowers was very powerful. It appeared to me to be somewhat similar to the combined odour of tea, hops, and senna-leaves. The flowers had apparently undergone no preparation beyond that of desiccation. The bunches of flowers were perfect and unbroken, though of course compressed. The general colour of the dried mass was greenish yellow; but when the flowers were more closely examined, the edges of the petals were seen to have a reddish or purplish colour. The taste of the dried flowers is at first not very marked, but after a few minutes a feeble senna-like, acrid, unpleasant taste becomes perceptible. By soaking the dried flowers in water they may be unfolded sufficiently to determine their botanical characters, which have been already described. When submitted to microscopic examination the hairs are perceived to be simple lymphatic hairs, tapering at the distal extremity.

COMMERCE.—In Abyssinia, two sorts of kosso are distinguished, viz., 1st, the *red* kosso, produced by the female-flowers; 2dly, the male flowers, known as *kosso-esels*. In commerce, the two sorts are always mixed.

ADULTERATION.—Considering the enormous price (about £1 15s. per ounce) at which kosso was sold in Paris, and the very limited quantity originally supplied by M. Rochet d'Hericourt, it cannot be surprising that the article should have been extensively adulterated. Indeed, I have been assured on credible authority, that the powder sold as "kousso" was, in fact, the powder of pomegranate bark; and that legal proceedings have been commenced in Paris to put a stop to the fraud, which is well calculated to injure the reputation of the genuine Abyssinian remedy. I have no doubt that the microscope would readily detect the substitution; but the surest way of obtaining the genuine article is to purchase the dried flowers in the entire state, not in the form of powder. [The enormous price paid in Europe a few years ago led to large consignments of the article, so that the wholesale price has been for some time reduced to the low figure of twopence per ounce. Hence, there is not that temptation to fraud which formerly existed. Kosso is sometimes imported in bundles 14 to 16 inches long on the stalk.—ED.]

CHEMISTRY.—The flowers of the Brayera (*i. e. kosso*) have been analysed by Wittstein (*antè cit.*) and by Martin (*Journ. de Chimie Méd.* t. vi. 2nde sér., p. 579., 1840). The following are the results obtained:—

Wittstein's Analysis.

Fatty oil...... Chlorophylle	1·44
Wax	2·02
Bitter acrid resin	6·25
Tasteless resin	0·77
Sugar	1·08
Gum	7·22
Tannin striking a green colour with iron	8·94
Tannin striking a blue colour with iron	15·46
Vegetable fibre	40·97
Ashes	15·71
	99·86
[Loss	00·14]
	100·00

Martin's Analysis.

Starch.
Saccharine matter.
Vegetable extractive matter.
Green very odorous resin.
Crystalline substance called *kwoséine.*

The *ashes* consist of potash, magnesia, lime, oxide of iron, sulphuric and phosphoric acids, chlorine, and silica.

With regard to the two kinds of *tannin*, Wittstein observes that, as far as he knows, this is the first instance recorded of a plant containing simultaneously two kinds of tannin, striking, the one a blue, the other a green colour with the salts of iron.

Although it is not improbable that the anthelmintic property of *kosso* may in part depend on tannin (since the pomegranate bark, which contains this principle in abundance, is, like *kosso*, also an anthelmintic), yet what may be termed the peculiar property of the kosso probably resides chiefly in the bitter acrid resin. This is soluble in alcohol and in ether, and appears to be a neutral body, manifesting neither distinct nor acid properties.

The crystalline principle to which Martin has given the barbarous name of *kwoséine* (from *kwoso*, the supposed name for *kosso*), is described as consisting of white silky crystals, having a styptic taste, and as being soluble in alcohol and sulphuric ether. They are said to redden litmus paper, and to dissolve, without undergoing decomposition, in sulphuric, nitric, and muriatic acids.

By boiling the dried plant in water a fragrant odour is evolved. No doubt this, as well as the odour of the dried plant itself, depends on the presence of a *volatile oil*, of which, however, no mention is made in Wittstein's analysis, the oil being present in too small a quantity to admit of its collection when small quantities of the flowers are operated on.

It is not improbable that the anthelmintic properties may in part depend on this oil, for Schimper states, that in Abyssinia the plant is considered to have lost its anthelmintic powers in the third year after its collection. In Europe, however, it retains its powers for a longer period (on account of the cooler climate?); for the flowers which have been used for all the recent experiments have been collected for more than four years, and we are told in the shop-bill of a Parisian pharmacien, that they may be kept for an indefinite period!

An infusion of a decoction of kosso strikes a dark green olive tint with a solution of the sesquichloride of iron.

MEDICINAL PROPERTIES. — Neither botanical characters, sensible qualities, nor chemical composition, would have induced us to suspect that *kosso* possesses the valuable anthelmintic properties which experience has shown that it does.

The general and prevailing quality of the Rosaceæ is astringency, dependent on the presence of tannic and gallic acids. This is observed in the flowers (*e. g.* rose petals), as well as in other parts of the plants. In this quality *kosso* agrees with its congeners. But it can scarcely be on this that its vermifuge property solely depends; otherwise rose petals, or any other equally powerful astringent, would be as effective in expelling worms as these Abyssinian flowers. But in Rosaceæ, as in many other families of the vegetable kingdom, anomalies exist—and to this head we must for the present be content to refer *kosso*.

Our confidence in the anthelmintic properties of kosso rests, then, on experience only; and the evidence on this point is very strong. All modern travellers in Abyssinia are agreed on the great success of the remedy on the natives of that country; and the experience of physicians in France, England, Germany, and Switzerland, has confirmed the favourable reports made by those who have seen the kosso used in its native country.

In Paris it has been employed with great success by Chomel and Sandras (*Ann. de Thérap. pour* 1847), as well as by numerous other distinguished physicians. In London our experience of it is much more limited; but the successful results of its use in King's College Hospital, in the hands of Drs. Budd and Todd (*Lancet*, March 16th, April 20th, and May 25th, 1850), and of Dr. Gull (*Lancet*, May 25th), in Guy's Hospital, confirm the favourable report of its efficacy which had reached this country from abroad.

The physiological effects of *kosso* are not in general very great. Sometimes it excites a slight sensation of heat, nausea, or even vomiting, creates thirst, and frequently, perhaps usually, a gentle action on the bowels. But the latter is commonly so slight, that in a considerable number of cases it is necessary to follow its administration by a mild purgative. It is obvious, therefore, that the efficacy of kosso as an anthelmintic does not depend on its purgative or evacuant influence, but on its poisonous or toxic action on the worm; in fact, it is a true *vermicide*. In one case, that of a woman in France, it brought away ten worms, of which one only manifested evidences of vitality, and that for a few minutes only.

Kosso appears to be an effective anthelmintic in both kinds of tape-worm, viz. the *Tænia solium*, and *Bothriocephalus latus*. In most of the reported successful cases, the *Tænia solium* was the parasite expelled; but in one of Chomel's cases, the worm which was evacuated was the *Bothriocephalus latus*, and I am informed that kosso has proved most effectual in Switzerland, where, as is well known, the *Bothriocephalus* is the prevailing tape-worm.

The dealers in kosso assert that one dose will, in every case, effect the radical cure of tape-worm. But this must be obviously an error. Even supposing that it invariably destroys all the worms in the alimentary canal at the time of its exhibition, it can in no way prevent their recurrence, provided the patient retains his predisposition (which there is no reason to suppose is affected by the kosso), and is subjected to the same influence. It certainly does not radically cure the Abyssinians, since, as several writers tell us, they resort to this remedy monthly. Schimper, the Governor of Adoa, says it does not completely expel the tænia, or at least rarely does so. But, he adds, that possibly in Europeans, in whom the verminant disposition is not so pronounced as in the Abyssinians, it may perhaps act in a more complete manner. In the Abyssinians this verminous disposition is innate, and is dependent, he adds, on the regimen which they adopt.

Hitherto the great drawback to the use of kosso has been the difficulty of procuring the remedy, and its enormous cost. At the time when it could be purchased in Paris its price was £1 15s. per oz. or 17s. 6d. per dose. M. Rochet d'Hericourt, the sole holder of the medicine at that time, refused to sell any quantity less than his entire stock, at the rate of one guinea per ounce! His nephew informed me that his uncle possessed 1400 lbs. of it, which, at one guinea per ounce, would cost 22,400 guineas!!! It does not appear that the remedy is very costly in Abyssinia. Schimper, writing from Adoa, in Abyssinia, says that it is found in commerce at a very low price. At Yangaro (commonly called Zingaro) the sovereign has the exclusive use of it, his subjects being prohibited from employing it; but in other parts free trade in kosso is permitted.

The flavour of *kosso*, though not very strong, is by no means agreeable; and is sufficiently powerful in some patients to create disgust and excite vomiting. In one case under M. Chomel (*Ann. de Thérap. pour* 1847), the whole of the remedy was rejected by vomiting.

No ill effects have resulted from its use in this country; nor have I met with any statement of its injurious action, except in Mr. Johnston's *Travels in Southern Abyssynia* (vol. ii. p. 272, 1844), where it is stated that its "operation is speedy and effectual; and to judge by the prostration of strength it occasioned in my servants when they employed this medicine, it must be dreadfully severe. I can answer for this, that it occasions frequent miscarriages, often fatal to the mother, and even men have been known, after a large dose, to have died the same day from its consequences. I am, therefore, surprised at the noise this remedy has occasioned the last few years in Europe, as if it promised to be a valuable addition to our Materia Medica. This, I conceive, can never be, for no civilised stomach could bear the bulk of the drug necessary to produce its effects. Even in Abyssinia it is but barely tolerated, and let another remedy equally efficacious for dislodging tape-worm be introduced into that country, and the use of kosso will be soon abandoned. In fact, several other vegetable productions are now employed to escape the punishment of a dose of this violent cathartic."

Administration.—Both Bruce (*op. ante cit.*) and Schimper (Bouchardat, *Annuaire de Thérapeut. pour* 1849, p. 257) tell us that the Abyssinians take a handful of the dried flowers as a dose. In Paris the dose has varied from four to six drachms. In general, however, half an ounce (troy weight) is considered a dose for an adult.

For different ages the doses are thus adjusted:—

Adults	1 dose	= 240 grs. (half-an-ounce)
Children of from 7 to 12 years	$\frac{2}{3}$ of a dose	= 160 grs.
„ 3 to 7 „	$\frac{1}{2}$ of a dose	= 120 grs.
„ not exceeding 3 „	$\frac{1}{3}$ of a dose	= 80 grs.

The kosso should be taken in the morning fasting. The only preparation necessary is, that the last meal of the previous evening should be slight. The evacuation of the bowels by a mild purgative or a lavement is also desirable.

The mode of administering the remedy is as follows:—The powdered flowers are to be mixed with luke-warm water (for an adult about ten ounces), and allowed to infuse for a quarter of an hour. A little lemon-juice is then to be swallowed, and, the infusion being stirred up, the whole is taken, liquid and powder, at two or three draughts, at short intervals, being washed down by cold water and lemon-juice. To promote the operation, tea (without sugar or milk) may be taken. In three or four hours, if the remedy has not operated, a dose of castor oil or a saline purgative should be administered.

2. Cherry Tree Gum.—From the stems of the *Cherry* (*Cerasus avium*), *Plum* (*Prunus domestica*), and some other rosaceous trees, there exudes a mucilaginous liquor, which concretes into tears, forming the *gummi nostras*, *cherry-tree gum* (*gummi cerasi*), *plum-tree gum* (*gummi pruni*). It may be employed in medicine as a substitute for tragacanth gum. It consists of two gummy principles: one called *arabine* (see *Gum Arabic*), soluble in cold water; the other termed *prunin* or *cerasin*, insoluble in cold, but soluble in hot water.

3. Alchemilla arvensis, *Field Ladies' Mantle* or *Parsley Piert*, is a small, indigenous, herbaceous plant, with green flowers. It belongs to *Tetrandria*, *Monogynia*, in the sexual system. It is astringent (owing to tannic acid), and, perhaps, slightly mucilaginous. It was formerly eaten raw or pickled, and thought serviceable in cases of gravel or stone: hence it was called *breakstone*. Prout[1] regards it as a diuretic, and

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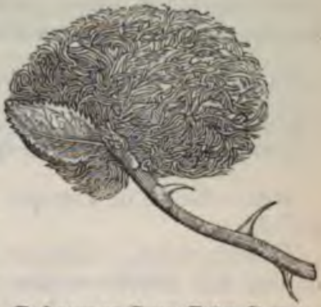
[1] *Inq. into the Nat. and Treat. of Diabetes*, &c. 2d ed. pp. 149 and 185.

as producing, in particular states of the system, a large secretion of lithic acid. A strong infusion of it, taken frequently, sometimes gives great relief, he says, in the less severe cases of the phosphatic or earthy deposit, where the source of irritation is chiefly confined to the urinary organs, and where the constitution is sound, and the strength not remarkably reduced.

FIG. 53.



Bedeguar or *Sweet Briar Sponge.*

4. BEDEGUAR. — On various species of *Rosa*, perhaps most frequently on *R. rubiginosa*, the *Sweet Briar* or *Eglantine*, is found a remarkable gall, called the *Sweet Briar Sponge* (*Bedeguar* seu *Fungus Rosarum*). Pliny terms it, in one place[1], *a little ball* (*pilula*), in another[2] *a sponglet* (*spongiola*). It is produced by the puncture of several insect species; viz. *Cynips Rosæ* and *Brandttii* (both of which are elaborately described by Ratzeburg[3]) and a species of *Mesoleptus*. Other species (as those of *Diptolepis* and *Pteromalus*) are also found in these galls; but they are probably parasites, and not the true inhabitants. The Bedeguar is usually rounded, but of variable size, sometimes being an inch or an inch and a half or more in diameter. Externally it looks shaggy, or like a ball of moss, being covered with moss-like branching fibres, which are at first green, but become afterwards purple and red. The nucleus is composed principally of cellular tissue, with woody fibre; and where the fibres are attached, bundles of spiral vessels are observed. Internally there are numerous shells, in each of which is the larva of an insect: if opened about August or September, maggots (larvæ) are usually found. It is inodorous, or nearly so; its taste is slightly astringent, and it colours the saliva brownish. It has not been analysed, but is suspected to contain tannic and gallic acids. Dried and powdered, it was formerly given in doses of from ten to forty grains, as a diuretic and lithontriptic. More recently it has been recommended as an anthelmintic, and as a remedy against toothache. Pliny says, the ashes mixed with honey were used as a liniment for baldness. In another place he speaks of the fungus being mixed with bear's-grease, for the same purpose.

TRIBE V. POMACEÆ.

278. CYDONIA VULGARIS, *Persoon, L. E.*—THE COMMON QUINCE.

Pyrus Cydonia, *Linn.*
Sex. Syst. Icosandria Pentagynia.
(Semen, *L.*)

HISTORY.—Hippocrates[4] employed the quince-apple (κυδώνια) as an astringent in diarrhœa. The Romans called this fruit *malum cotoneum.*[5]

BOTANY. **Gen. Char.**—*Calyx* 5-cleft. *Petals* somewhat orbicular. *Stamens* erect. *Styles* 5. *Pome* closed, 5-celled; cells many-seeded, cartilaginous. *Seeds* enveloped with a mucilaginous pulp.—Small *trees.* *Leaves* undivided, quite entire or serrate. *Flowers* large, solitary or few, somewhat umbellate (De Cand.)

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[1] *Hist. Nat.* lib. xxi. cap. 73, ed. Valp.
[2] *Ibid.* lib. xxv. cap. 6.
[3] *Mediz. Zoolog.* Bd. ii. S. 146, et seq.
[4] *Opera*, 497, ed. Fœs.
[5] Pliny, *Hist. Nat.* lib. xv. cap. 11, ed. Valp.

Sp. Char.—*Leaves* ovate, obtuse at the base, quite entire; their lower surface, as well as the *calyx*, tomentose (De Cand.)—A small, much-branched, usually crooked *tree*. *Petals* pale rose-colour or white. *Pome* varying in shape, yellow, covered with a thin cottony down, very austere, but having a peculiar fragrance.

De Candolle admits three varieties:—

α. *Maliformis*. *Apple Quince.*—*Pome* almost globose. Cultivated.
β. *Lusitanica*. *Portugal Quince.*—*Leaves* broader. *Pome* larger. Cultivated.
γ. *Oblonga*. *Oblong* or *Pear Quince.*—*Leaves* oval or oblong. Cultivated and wild.

Hab.—South of Europe. Cultivated in gardens. Flowers in May and June.

DESCRIPTION.—Quince seeds (*semina cydoniæ*) are ovate-acute, flat on one side convex on the other, and of a reddish-brown colour. The most external coat (*epidermis seminalis*, Bischoff) is composed of very fine cells, in which is lodged a large quantity of mucilage. When, therefore, these seeds are thrown into water, the mucilage swells up, distends, and ultimately bursts the tender cells.[1]

COMPOSITION.—No analysis of either fruit or seeds has been made. The *FLESHY PULP* of the fruit contains an *astringent matter*, *malic acid*, *sugar*, *pectine* or *vegetable jelly*, a *nitrogenous matter*, probably *volatile oil*, *water*, and *vegetable fibre*. The *SEEDS* contain *colouring matter*, *tannic acid*, a large quantity of a *peculiar gummy matter* in their outer coat, probably *amygdalin* (as Stockman obtained hydrocyanic acid from the seeds by distillation), *emulsin*, *starch*, *fixed oil*, and *woody fibre*.

CYDONIN (*Peculiar Gum of Quince Seed; Bassorin; Mucus; Quince Mucilage*).—One part of quince seed forms, with forty parts of water, a thick mucilage, which produces, with the following salts, gelatinous coagula, or precipitates; acetate and diacetate of lead, protochloride of tin, nitrate of mercury, and sesquichloride of iron. Rectified spirit produces at first scarcely any effect; after some time partial coagulation is effected. Oil of vitriol communicates a pinkish tint, and causes the separation of a frothy coagulum, which floats on the mixture. Silicate of potash, infusion of nutgalls, and oxalate of ammonia, produce no change in the mucilage. Quince mucilage, usually termed bassorin, appears to me to be a peculiar substance: hence I propose to call it *cydonin*. It is distinguished from *arabine* [see *Gum Arabic*] by the effect on it of alcohol, silicate of potash, sulphuric acid, and oxalate of ammonia; from *bassorin* and *cerasin* (see below) by its solubility in water, both hot and cold; from *tragacanthin* (see *Gum Tragacanth*) by the effect of sulphate of iron, oxalate of ammonia, and alcohol; from *carrageenin* by the effect of silicate of potash and acetate of lead.[2]

PHYSIOLOGICAL EFFECTS.—The *fruit* is not eatable in its raw state. Stewed in pies or tarts, along with apples, it is much esteemed. The expressed juice (*succus cydoniæ*) is said to be cooling and astringent. An excellent *marmalade* (*miva cydoniæ*) and *syrup* are prepared from the quince by the confectioner. The *mucilage of quince seed* is nutritive, demulcent, and emollient. The whole seeds, if taken in sufficient quantity, and well masticated, would, perhaps, act like bitter almonds, as they are said to yield hydrocyanic acid.

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[1] See Bischoff, *Handb. d. bot. Termin.* tab. xlii. fig. 1859.

[2] For some experiments on mucilage of quince seed, see Bostock, in *Nicholson's Journal*, vol. xviii. p. 31.

USES.—Quince seeds are employed in medicine only on account of the mucilage which they yield.

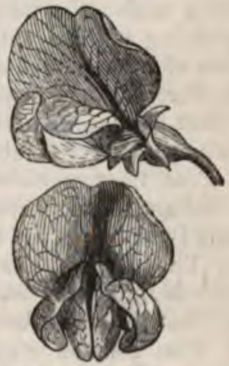
DECOCTUM CYDONII, L.; *Mucilage of Quince Seed.* (Quince Seeds, ʒij.; Distilled Water, Oj. Boil with a gentle heat for ten minutes, and strain).—Never used internally. Employed externally as an emollient and sheathing application to cracked lips and nipples; to the inflamed conjunctiva; to the skin when affected with erysipelas; and to painful hemorrhoidal tumours. Hair-dressers use it, as a cement, for dressing the hair in braids.

ORDER LXV. LEGUMINOSÆ, *Jussieu.*—THE BEAN TRIBE.

Fabaceæ, *Lindley.*

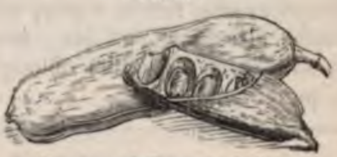
CHARACTERS.—*Calyx* of 5 (rarely of 4) sepals, more or less united at the base, and, therefore, 5-toothed, 5-cleft, or 5-partite; sepals unequal, in some cases almost equally coherent, in others concreted into 2 lips; the upper consisting of 2 sepals which are either free at the apex or united; the lower of 3 sepals generally distinct at the apex. *Petals* 5, or, by abortion, 4, 3, 2, 1, or none; generally unequal, inserted usually into the base of the calyx, rarely on the torus; in general variously imbricated, rarely valved, almost always free, sometimes united into a gamopetalous corolla. [In the sub-order *Papilionaceæ*, the petals form a *butterfly-shaped* or *papilionaceous* corolla, composed of a large upper petal, called *vexillum* or *standard*, two lateral ones, termed *alæ* or *wings*, and an inferior keel-shaped one denominated *carina* or *keel*, and which is, in fact, composed of two petals adherent by their margin.] *Stamens* inserted with the petals, generally double the number of the latter, rarely triple or quadruple or fewer; altogether free, or the filaments variously connected, being monadelphous, with the tube entire or cleft above, or diadelphous 9 and 1, or 5 and 5, very rarely triadelphous; *anthers* two-celled. *Carpel* generally 1, the others being abortive; or 2 to 5. *Ovary* oblong or ovate, sessile, or stipitate, free, or, very rarely, adnate by the stipe to the calyx. *Style* 1, filiform, arising from the upper suture: *stigma* terminal or lateral. *Legumes* 2-valved, membranous, coriaceous, rarely fleshy or drupaceous, dehiscent or indehiscent; 1-celled; or by the folding in of one of the sutures, longitudinally 2-celled; or by isthmi or articulations, transversely many-celled. Seeds 2, or many, or by abortion (?) solitary, affixed to the upper suture, inserted alternately into each valve, frequently oval or reniform; *funiculus* various, rarely expanded into an arillus; *testa* smooth, frequently very much so, and stony; *endopleura* often tumid, simulating albumen. *Embryo* sometimes straight [*rectembriæ*], or curved [*curvembriæ*], the radicle being inflexed on the commissure of the lobes (*homotropal* or *pleurorhizous*); in either case the radicle directed towards the hilum; *cotyledons* foliaceous or fleshy; the first exsert, the

FIG. 54.



Papilionaceous Flowers.

FIG. 55.

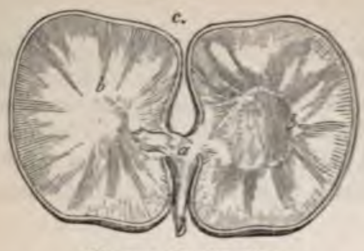


Legumes of Ceratonia Siliqua.

latter germinating within the spermoderm, under ground.—*Trees, shrubs*, or *herbs*, with alternate, bistipulate, simple, or variously-compounded *leaves*.—(Condensed from De Candolle, with additions within the square brackets.)

PROPERTIES.—Exceedingly variable. Similar organs of different, though often closely-allied, species are frequently found to elaborate most dissimilar principles; and, of course, the dietetical, medicinal, or poisonous properties vary in a corresponding manner.—For details, consult Dierbach, *Abhandl. üb. d. Arzneikrafte der Pflanzen*; and De Candolle, *Essai sur les Propr. Méd.*

FIG. 56.



Common Garden Bean.
a. Plumule. *b*. Cotyledons or seed lobes. *c*. Radicle bent on the cotyledons (*curvembriæ*).

Sub-order I. PAPILIONACEÆ.

279. MYROSPERMUM (*Myroxylon*), *Species incertæ* (*Peruiferum*), *De Cand., E.* —THE QUINQUINO.

Myroxylon peruiferum, *Linn.*
Sex. Syst. Decandria Monogynia.
(Balsamum ex inciso trunco fusum, *L.*—Fluid balsamic exudation, *E.*—Balsamum, *D.*)

HISTORY.—The balsam of Peru was first mentioned by Nicholas Monardes under the name of *balsamum*.[1] No accurate notions of the tree yielding it were entertained until 1781, when Mutis sent some branches of it to the younger Linnæus.[2] Ruiz[3] afterwards described it.

[Dr. Pereira, in a paper published in the Pharmaceutical Journal, stated that from specimens and information which he had received from Mr. Skinner, late of Guatemala, he had ascertained:—

1st, That the tree which yields the so-called balsam of Peru and the white balsam, is a species different from that described by Ruiz and Lambert (which was the Myrospermum pubescens, De Cand.).

2nd, That black balsam (balsam of Peru of commerce) is obtained by incisions into the stem.

3rd, That the white balsam is procured from the fruit by pressure.

4th, That commerce exclusively obtains both of these balsams from the so-called Balsam Coast in Central America, and that the tree grows principally near Sonsonate; hence Dr. Pereira proposed to name it the Myrospermum of Sonsonate. But Dr. Royle has since named it "*Myrospermum Pereiræ*." The parts which Dr. Pereira described were the branches, leaves, and fruit.

Branches one, terete, warty, ash-coloured.

Leaves alternate, petiolate, impari-pinnate. Leaflets 5 to 11, alternate, with short footstalks oblong or ovate, abruptly acuminate, emarginate, punctated.

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[1] Clusius, *Exot.* 303.
[2] Murray, *App. Med.* vi. 111.
[3] Lambert, *Illustr. of the Genus Cinchona*, p. 92.

Fruit, a 1-celled sumara, fruit-stalked, winged above.

The balsam is contained in the fibrous mesocarp, principally in two lateral villæ, but also in smaller receptacles.

The seed is dry, covered by a thin testa; the cotyledons are yellow and oily.

The known productions of this tree are black balsam, commonly called Balsam of Peru, White Balsam, Balsamelo.

BLACK BALSAM.—This is obtained in the way described by Mr. Victor le Nora. The average production is about 25,000 lbs. per annum.

There being a controversy regarding the true method of obtaining this balsam, Mr. Saravia of Sonsonate made particular inquiries, and states that: "The balsam is extracted by making several incisions in the tree, in which are placed rags, which, when well soaked, are boiled in water, and the balsam allowed to subside. The water is then poured off, and the impure balsam packed in gourds."

Dr. Pereira states that the only purification it undergoes in England is a mechanical one, setting it to stand for the water to separate.[1]—ED.]

BOTANY. **Gen. Char.** — *Calyx* campanulate, 5-toothed, persistent. *Petals* 5, the upper one largest. *Stamens* 10, free. *Ovary*, stipitate, oblong, membranous, with 2 to 6 ovules; *style* towards the apex, filiform, lateral. *Legume*, with stalk naked at the base but winged superiorly, samaroïdal [*legumen samaroïdeum*, De Cand.], indehiscent, 1-celled, 1- or 2-seeded, laterally pointletted by the style. *Seed* besmeared with balsamic juice; *cotyledons* thick, plane (De Cand.)

Sp. Char.—*Leaves* coriaceous, persistent, smooth as well as the *branches*. Wing of the *legume* very thick, not veined. *Style* deciduous (De Cand.)

A branching, elegant *tree*. *Bark* thick, very resinous. *Leaves* pinnated, alternate; leaflets 2 to 5 pairs, alternate ovate-lanceolate. *Racemes* axillary. *Petals* white. *Legume* somewhat coriaceous, straw-coloured, about four inches long including the stalk. *Seeds* reniform.

Hab.—Peru, New Grenada, Columbia, and Mexico. Grows in low, warm, and sunny situations.—Flowers from August to October.

COLLECTION.—Monardes[2] says, that there are two modes of procuring the balsam; viz. incision into the bark of the tree, and coction of the branches and trunk in water. The first method yields a *white liquid balsam*, the second a *blackish red liquid.* Ruiz[3] states, that the white liquid balsam is preserved for years in bottles, in the fluid state; but when deposited in mats or calabashes, which is commonly done in Carthagena, and in the mountains of Tolu, it, after some time, condenses, and hardens into resin, and is then denominated *dry white balsam*, or *balsam of Tolu;* while the extract made by boiling the bark in water is blackish, remains liquid, and is known by the name of *black Peruvian balsam.* There is, however, obviously some confusion in this statement; and several reasons have led pharmacologists to doubt whether the black balsam of the shops is obtained by coction. Ruiz does not speak from his own observation, but on the authority of Valmont de Bomare. Lastly,

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[1] *Pharm. Journal*, vol. x. p. 230 and 280; vol. xi. p. 204.

[2] *Op. cit.* p. 302.

[3] *Op. cit.* p. 95.

Hernandez[1] says the balsam obtained by incision is yellowish-black (*e fulvo in nigrum*). Professor Guibourt has received, from M. Bazire, balsam of Peru, which he obtained in great abundance on the coast of Son Sonaté, called the Balsam Coast, in the state of San-Salvador (the republic of Guatemala) by incisions in the stem of a Myrospermum, the fruit of which is very different from that of M. Toluiferum.[2] Th. Martius[3] suggests, that the black balsam of Peru is procured by a kind of *destillatio per descensum;* but the absence of pyrogenous products in the balsam seems to me to be opposed to this opinion.

[M. Victor le Nouvel, who has been engaged in collecting this balsam since 1836, gives the following as the process used by the Indians to obtain it:—An incision is made into the tree of about two or three inches broad, and three to four inches long. They raise the bark from the wood, and apply cotton rags to it; a fire being lighted round the tree to liquify the balsam. Fresh incisions are made higher and higher up the tree, till the cotton rags are quite saturated. It takes from ten to twelve days to effect this. The rags are next boiled; and when the liquor is cold, the balsam collects below.]

COMMERCE.—Balsam of Peru is imported in pear-shaped earthenware pots and in tin canisters, from Valparaiso, Islay, Lima, Truxillo, Callao, Iquique, and Belize. The duty (1s. per lb.) paid on it during six years was as follows:[5]—

In 1834	1893 lbs.	In 1837	1331 lbs.
1835	243	1838	1798
1836	1880	1839	825

[The duty paid in the years 1841–4 was on the following quantities:—

In 1840	1017 lbs.	In 1843	967 lbs.
1841	949	1844	1308—ED.]
1842	1011		

DESCRIPTION.—Balsam of Peru (*balsamum peruvianum*) called also *black* or *liquid balsam of Peru* (*balsamum peruvianum nigrum*) is a transparent deep reddish-brown or black liquid, which has the consistence of treacle, a powerful but agreeable odour, somewhat similar to that of vanilla and benzoin, and which is increased by dropping the balsam on a red-hot coal, and a warm, acrid, bitter taste. It is inflammable, and burns with a fuliginous flame. It is soluble in alcohol; the solution, however, is not clear, but lets fall after some time a deposit. To boiling water it yields its acid, usually stated to be the benzoic, but, according to Frémy and others, it appears to be the cinnamonic acid. Its sp. gr. is 1·150 to 1·160.

I have received from Professor Guibourt another balsamic substance under the name of *balsam of Peru in cocoa-nut shells* (*baume du Pérou en cocos*). The shell has the size and shape of a small lemon. The contained balsam is of a deep brown colour, and has an odour very similar to that of balsam of Tolu. Guibourt says, "it appears to be formed of two kinds of matter: one more fluid, another more solid, grumous, and as it were crystalline. Its taste is mild and sweetish. It has a strong agreeable odour, between that of Tolu and soft liquidambar, but distinct from both."

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[1] *Rep. Med. Nov. Hisp. Thes.* p. 51, 1651.
[2] *Hist. des Drog.* ii. 3^{me} éd. 590.
[3] *Pharmakogn.*
[4] *Pharm. Journ.* vol. xi. p. 260.
[5] *Trade List.*

The *white balsam of Peru* (*balsamum peruvianum album*) of Martius, and other pharmacologists, is said, by Guibourt,[1] to be the *solid balsam of liquid ambar* already described.

ADULTERATION.—Balsam of Peru is said to be subject to adulteration; and the formulæ given by Gray[2] for *making* as well as for *reducing* (*i. e.* adulterating) it, lend support to this opinion. The demand for the balsam being small, the supply quite equal to or even exceeding the demand, and the price being moderate, are circumstances which appear to remove all motive for adulteration, which I do not think is at present practised in this country. [When newly imported, it generally contains a little water, and also some sediments. The importers generally get it turned out and bulked at the docks, so as to obtain the real tare, and to separate the water and sediments. These latter are put into separate jars, and are sold as sediment or refuse.—ED.] The characters to be attended to in judging of its genuineness are, the purity of its odour, its complete solubility in, or miscibility with, alcohol (by which the absence of fixed oil is shown), and its undergoing no diminution of volume when mixed with water (by which the absence of alcohol is proved). A sign of its purity is, that 1000 parts of it should saturate 75 parts of pure crystallised carbonate of potash.[3] [Ulex states that the adulteration with castor oil can be detected by adding concentrated sulphuric acid, and subsequently water, when a brittle resin is formed, if the balsam be pure; but it becomes softer in proportion to the amount of fixed oil mixed with it.[4] Copaiba is shown to be present by distilling a few drops, and adding iodine, when an explosion results, if this oil has been added.[5] —ED.]

COMPOSITION.—Balsam of Peru has been elaborately investigated by several chemists, and the results obtained are somewhat curious. In 1806 it was examined by Lichtenberg.[6] Stoltze,[7] in 1825, published an analysis of it. Richter,[8] Plantamour,[9] and Frémy,[10] have since examined the nature of its constituents.

Stoltze's Analysis.

Brown slightly soluble resin	2·4
Brown resin	20·7
Oil of balsam of Peru [*cinnaméine*]	69·0
Benzoic [*cinnamonic*] acid	6·4
Extractive	0·6
Loss and moisture	0·9
Balsam of Peru	100·0

Frémy's Analysis.

1. An oily matter [*cinnaméine*], frequently containing, in solution, a crystalline substance (*metacinnaméine; hydruret of cinnamyle*).
2. Cinnamonic acid.
3. One or more resins (*hydrates of cinnaméine*).

Balsam of Peru.

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[1] *Op. cit.*
[2] *Suppl. to the Pharm.*
[3] Th. Martius, *Pharmakogn.*
[4] *Archiv der Pharmacie*, Jan. 1853.
[5] *Pharm. Journ.* vol. xii. p. 549.
[6] *Berlin. Jahrb.* 1806, S. 22.
[7] *Journ. de Chim. Méd.* i. 139.
[8] *Pharm. Cent.-Blatt. für* 1838, S. 346.
[9] *Ibid.* S. 825, and *für* 1839, S. 601.
[10] *Comptes-Rendus*, 1838, Sec. Sem. No. 20; and *Ann. de Chim. et de Phys.* t. lxx. p. 180.

1. OIL OF BALSAM OF PERU; *Cinnaméine* of Frémy.—If an alcoholic solution of potash be added to an alcoholic solution of balsam of Peru, a compound of resin and potash (*resinate of potash*) is precipitated, while cinnamonate of potash and cinnaméine are left in solution. On the addition of water the latter separates, and floats on the surface. It is to be purified by solution in petroleum. Cinnaméine is a reddish-brown, acrid, odourless, oily fluid, heavier than water, soluble in alcohol and ether, insoluble in water, and inflammable. Its composition, according to Frémy, is (taking the average of five experiments), *carbon* 79·0, *hydrogen* 6·26, *oxygen* 14·74. His formula for it, which, however, scarcely accords with this statement, is $C^{58}H^{26}O^{8}$ [$C^{144}H^{65}O^{20}$, Liebig]. Caustic potash effects a change on it analogous to saponification, and converts it into two equivalents of cinnamonic acid (equal to $C^{38}H^{14}O^{6}$) and a light oily fluid, which Frémy calls *peruvine*, whose composition is, *carbon* 79·6, *hydrogen* 9·3, *oxygen* 11·1, or $C^{18}H^{12}O^{2}$ [$C^{36}H^{25}O^{4}$, Liebig]. Cinnaméine frequently (but not invariably) contains in solution a crystalline substance, termed *metacinnaméine*, whose composition is, *carbon* 81·9, *hydrogen* 6·0, *oxygen* 12·1; its formula being $C^{18}H^{9}O^{2}$, so that it is isomeric with *hydruret of cinnamyle.* Richter asserts that oil of balsam of Peru is composed of two distinct oils—one, called *myrospermine*, which is soluble in alcohol; the other, termed *myroxiline*, insoluble in alcohol. What relation these oils bear to cinnaméine and peruvine has not yet been made out.

2. CINNAMONIC ACID; *Cinnamic Acid.*—This constituent has usually been mistaken for benzoic acid. It is obviously formed in the balsam by the oxidation of the hydruret of cinnamyle, just as hydruret of benzule is transformed into benzoic acid. In those balsams of Peru which contain no *metacinnaméine*, this principle has been entirely converted into cinnamonic acid.

3. RESIN OF BALSAM OF PERU; *Hydrate of Cinnaméine.*—The quantity of resin in balsam of Peru augments daily. It is formed by the union of cinnaméine with the elements of water; for its composition is *carbon* 71·82, *hydrogen* 6·78, *oxygen* 21·40; or $C^{54}H^{30}O^{12}$. So that this resin consists of one equivalent cinnaméine, and four equivalents of water. It is not, however, formed at once, but it gradually undergoes different degrees of viscosity. Soft resin differs from the hard only in its elements of water. Sulphuric acid converts cinnaméine into resin.

Such are the general results of Frémy's analysis; but the correctness of some of them may be fairly called in question. His formulæ do not always agree with his experimental results (see cinnaméine). Plantamour denies the accuracy of several of Frémy's statements.

PHYSIOLOGICAL EFFECTS.—Stimulant, slightly tonic, expectorant, detergent, and epulotic. Its action is similar to other balsamic substances, and is closely allied to that of storax and benzoin. Topically it operates as a stimulant and mild acrid; and when applied to foul indolent ulcers, often cleanses them, and promotes their cicatrization. Taken internally, in full doses, it creates thirst, and quickens the pulse. Its stimulant influence is directed to the secreting organs, especially the bronchial mucous membrane. It is devoid of the powerful influence over the urinary organs possessed by copaiva and the turpentines, and its tonic powers are not equal to those of myrrh.

USES.—Its supposed efficacy in curing external ulcers and healing wounds has led to its use in internal diseases, formerly apprehended to depend on ulceration, as in pulmonary affections supposed to be, or which really were, phthisis. But the observations of Dr. Fothergill[1] in part led to the discontinuance of the indiscriminate use of balsams and other heating substances in these cases. Yet it proves serviceable in some old asthmatic cases, chronic pulmonary catarrhs, winter coughs, &c. It seems to be principally adapted to *old-standing chronic affections of the mucous membranes* (especially the bronchial mucous membrane), particularly in persons of a cold and torpid habit. Its stimulant influence is calculated only to aggravate acute cases.

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[1] *Med. Obs. and Inq.* vol. iv. p. 231.

Many other uses of balsam of Peru are now obsolete: as its employment in lead colic, as recommended by Sydenham; in gonorrhœa and leucorrhœa by Hoffman[1]; in convulsions from repressed perspiration by Kirkland[2]; and externally and internally in traumatic tetanus by Dr. Kollock.[3] It is said to be now and then used in chronic rheumatism. The beneficial effects ascribed by Trousseau and Pidoux to the balsams in chronic laryngitis have been before referred to.

As a topical remedy, balsam of Peru is occasionally employed. It is applied either alone, or in the form of ointment, to indolent ill-conditioned ulcers; it cleanses them, promotes healthy granulation, and assists cicatrization. I have used it in some obstinate ulcerations about the nose. Dr. Ainslie[4] speaks very highly of its powers of arresting the progress of sphacelous and phagedenic affections, so common and destructive in India. He recommends lint, soaked in the balsam, to be applied night and morning. In offensive discharges from the ear, it is now and then dropped in after syringing. It is a constituent of some lip-salves. It was formerly esteemed as a vulnerary against wounds of the tendons and nerves. It is used by perfumers for *scenting*, and in the manufacture of *fumigating pastiles*.

ADMINISTRATION. — Dose, fʒss. to fʒj. It may be taken on sugar, or made into pills with some absorbent powder, or diffused through water by means of sugar, honey, gum, or yolk of egg.

[SONSONATE OR ST. SALVADOR WHITE BALSAM. — Dr. Pereira (*loc. cit.*) states that this is often confounded with balsam of Peru, but its properties are quite distinct. It is obtained at Sonsonate, by pressure without heat, from the fruit after removing the outer fibrous portions of the epicarp and merocarp.

The product probably consists of the oleoresinous matter contained in the pericarp and the fatty and other constituents of the seed. It is imported in globular earthen jars, surrounded by matting, and containing about 20 lbs. each.

APPEARANCE. — It closely resembles strained Bordeaux turpentine. It is semi-fluid, somewhat granular. By standing it partly separates into a white opaque crystalline resinous deposit, and a superior more translucent thinner portion. Its odour is agreeable, but unlike that of balsam of Peru, or of Tolu. It is partly soluble in alcohol, but more in ether.

From the white balsam of Sonsonate, Dr. Stenhouse has obtained broad, thin, prismatic, colourless crystals, which he terms *Myroxocarpum*. They are hard, destitute of taste, insoluble in water, but soluble in hot alcohol or ether; their solution is neutral to test paper.

Composition of White Balsam.

Carbon	77·63	48
Hydrogen	9·43	35
Oxygen	12·94	6
	100·00	

From its chemical property it appears to be an indifferent crystallisable resin.

BALSAMELO. — This is a tincture made by digesting the fruit in rum. It is a clear liquid, the colour of sherry wine, having an odour like the tonka bean, and a bitter taste.

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[1] *Opera omn. Suppl.* p. 736. Genev. 1754.

[2] *Treat. on Childbed Fever*, p. 31, 1774.

[3] Thacher's *Dispensatory*.

[4] *Mat. Ind.* i. 65 and 406.

It is considered to be a stimulant, diuretic, and anthelmintic. It is used in doses of 1 dram in fainting fits, dyspepsia, colic, hysteria, and worms. Also externally as an application to sloughing sores, especially those produced by the chigoe (Pulex penetrans).[1] — ED.]

280. MYROSPERMUM TOLUIFERUM, *Richard, E.*—THE BALSAM OF TOLU-TREE.

Toluifera Balsamum, *Miller, D.*

Sex. Syst. Decandria Monogynia.

(Concrete balsamic exudation, *L.*—Balsamum ex inciso trunco fusum concretum, *D.*)

HISTORY. — The earliest notice of balsam of Tolu is that of Monardes.[2] He tells us that the balsam had been recently imported.

BOTANY. **Gen. Char.** — See *Myrospermum peruiferum.*

Sp. Char. — *Branches* and *leaves* smooth. *Leaflets* oblong, acuminate, equilateral, rounded at the base (De Cand.)

The tree which yields the balsam of Tolu was formerly called *Toluifera Balsamum.* But Richard having carefully investigated the characters of the genus Toluifera, found that, with the exception of those of the fruit, which Miller had imperfectly described, they were identical with those of the genus now called Myrospermum; and as Ruiz states that the balsams of Peru and Tolu are both obtained from one tree, the *Myrospermum peruiferum* has been adopted by several writers, and by the London College, as the source of both balsams.

Richard[3] found specimens of the trees yielding these balsams in Humboldt's herbarium; and though he at first mistook them for the same species, he has subsequently recognised them to be different. He therefore made a distinct species of the tree yielding the balsam of Tolu, and it is now called *Myrospermum toluiferum.* It differs from M. peruiferum in its having thin, membranous, obovate leaflets, which are lengthened and acuminated at their summits. Moreover, the terminal leaflet is larger than the lateral ones.

Hab. — Mountains of Tolu, Turbaco, and on the banks of the Magdalena, between Garapatas and Monpox.

PRODUCTION. — Balsam of Tolu is procured by making incisions into the bark of the tree, and receiving the liquid balsam in vessels made of a black wax. It is afterwards transferred into proper vessels. It only exudes from the tree during the heat of the day.[4]

COMMERCE. — Balsam of Tolu is sometimes brought direct from Carthagena, Santa Martha, and Savanilla; more commonly, however, it comes by way of New York or Jamaica. It is usually imported in cylindrical tin canisters; now and then in earthen pots or jars; still more rarely in small calabashes.

DESCRIPTION. — Balsam of Tolu (*balsamum tolutanum* vel *de Tolu*), when first brought over, is generally soft and tenacious, but by age becomes hard and brittle, somewhat similar to resin, and has a granular or somewhat crystalline appearance. Formerly it was imported in this hardened state, but is now usually met with in the soft state. It is transparent, has a reddish or yellowish-brown colour, a most fragrant odour, though less powerful than that of storax or Peruvian balsam, and a pleasant sweetish taste. It softens under the teeth; when heated, it readily melts, takes fire, and burns with an agreeable odour. It is very soluble in alcohol and ether, and gives out its acid to water. The soft balsam contains more oil but less acid than the dry balsam, the acid and the resin being formed at the expense of the oil. Balsam of Tolu hardens or resinifies with much more facility than balsam of Peru.

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[1] *Pharm. Journal*, vol. x. p. 287.

[2] Clusius, *Exot.* 304.

[3] *Ann. Scien. Nat.* t. ii. p. 168.

[4] Monardes, *op. cit.* 304.

Balsam of Tolu in calabashes (*balsamum tolutanum in cucurbitis parvis*, Dale) occurs in calabashes (the fruit of *Crescentia Cujete*, according to Sloane[1]) about the size of an orange; the large aperture by which the balsam has been introduced being closed with the rachis of the fruit of *Zea Mays*.

[ADULTERATION.—Ulex states[2] that colophony is present, if the balsam, instead of dissolving in sulphuric acid, swells up, blackens, and disengages sulphurous acid.[3]—ED.]

COMPOSITION.—According to Frémy,[4] the composition of balsam of Tolu is similar to that of balsam of Peru, its constituents being *cinnaméine*, *cinnamonic acid*, and *resin*. They differ, according to the same chemist, from those of balsam of Peru by the greater facility with which they become resinified.

RESIN OF BALSAM OF TOLU.—Is essentially the same as that of balsam of Peru, and, like it, also forms a fine red colour with sulphuric acid; but it is less fusible than the resin of the last-mentioned balsam. It consists of *carbon* 70·8, *hydrogen* 6·1, and *oxygen* 23·1; so that it contains a larger proportion of the elements of water.

PHYSIOLOGICAL EFFECTS AND USES.—The effects of balsam of Tolu are similar to those of balsam of Peru, and the other balsamic substances. It is employed as a stimulating expectorant in chronic bronchial affections, unaccompanied with inflammatory action. It is, however, more frequently used as an agreeable flavouring adjunct to pectoral mixtures. The vapour of the ethereal solution of the balsam has been inhaled in chronic affections with benefit. *Tolu lozenges* form a popular and pleasant remedy for appeasing troublesome cough. The balsam is sometimes employed by confectioners to flavour *sweetmeats*, as marmalade. It is also used *in perfumery;* and is a constituent of some *fumigating pastiles* already described.

ADMINISTRATION.—The dose of the balsam is from grs. x. to ʒss. It may be taken in the form of an *emulsion*, made with gum or sugar. It is a constituent of the *compound tincture of benzoin*, L. D., before described.

1. **TINCTURA TOLUTANA**, L. E. D.; *Tincture of Tolu*. (Balsam of Tolu, ℥ij. [℥iiss. in coarse powder, *E.*]; Rectified Spirit, Oij. [Oj. *D.*] Digest [with a gentle heat, *E. D.*] until the balsam is dissolved, and filter, *L.* [Let it stand until the sediment subsides, then decant the clear tincture, *D.*]—A stimulating expectorant, principally used as a flavouring adjunct to other pectorals. Its use is, of course, objectionable in

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[1] *Hist. Nat. Jamaica*, ii. 174.

[2] *Archiv der Pharmacie*, Jan. 1855.

[3] *Pharm. Journ.* vol. xii. p. 530.

[4] *Ann. de Chim. et de Phys.* t. lxx. p. 201.

flammatory cases. Dose, fʒss. to fʒij. When mixed with water the resin is precipitated: hence it should be rubbed with mucilage, or some viscid liquor, before adding the water, to keep the resinous precipitate in suspension.

2. **SYRUPUS TOLUTANUS**, L. E. D.; *Syrup of Tolu; Balsamic Syrup.* (Balsam of Tolu, ʒx.; Boiling Distilled Water, Oj.; Sugar, lb. iiss. Boil the balsam in the water for half an hour in a vessel lightly covered, frequently stirring, and strain the cooled liquor; then add the Sugar, and dissolve it, *L.*—Simple Syrup, lbs. ij.; Tincture of Tolu, ℥j. When the syrup has been recently prepared, and has not altogether cooled, add the tincture of Tolu by degrees, agitating briskly, *E.*—Balsam of Tolu, ℥j.; Distilled Water, Oj.; Refined Sugar, in powder, as much as is sufficient. Boil the balsam in the water for half an hour, in a lightly covered vessel, occasionally stirring, and strain the liquor when cold; then, having added to it twice its weight of sugar, dissolve with the aid of a steam or water heat, *D.*) [The United States Pharmacopœia directs Tincture of Tolu, ℥iss.; Water, Oj.; Sugar, lbiiss. Mix the Tincture with the Sugar in coarse powder: expose the mixture in a shallow dish to a gentle heat until the alcohol has evaporated: then, pour the water upon it in a covered vessel: beat gradually until the sugar is dissolved, and strain.—ED.] Employed as an agreeable flavouring adjunct to pectoral mixtures.—Dose, fʒj. to fʒiv.

281. CYTISUS SCOPARIUS, *Decand. L. E.*—COMMON BROOM.

Spartium scoparium, *Linn. D.*
Sex. Syst. Diadelphia Decandria.
Cacumen recens et exsiccatum, *L.*—Tops, *E.*—Cacumina, *D.*

HISTORY.—It is uncertain who first mentioned this plant. The *σπάρτιον* of Dioscorides[1] is *Spartium junceum* or *Spanish Broom.*[2] The *Genista* of Pliny[3] was probably the same plant, though the Roman historian was himself doubtful whether this plant was identical with that of the Greeks. Sprengel[4] considers that Theophrastus was undoubtedly acquainted with Common Broom.

BOTANY. **Gen. Char.**—*Calyx* 2-lipped; the upper lip generally entire, the lower one somewhat 3-toothed. *Vexillum* ovate, large; *keel* very obtuse, enclosing the stamens and pistils. *Stamens* monadelphous. *Legume* plano-compressed, many-seeded, without glands.—*Shrubs. Leaves* trifoliate (De Cand.)

Sp. Char.—*Branches* angular, smoothish. *Leaves* trifoliate, stalked. *Tops* simple. *Leaflets* oblong. *Flowers* axillary, stalked, solitary. *Legumes* hairy at the margin (De Cand.)

A *shrub*, 3 to 6 feet high. *Branches* long, straight, and green. *Leaves* deciduous; upper ones generally simple. *Flowers* large, bright yellow;

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[1] Lib. iv. cap. 158.
[2] Smith, *Prodr. Fl. Græc.* ii. 53.
[3] *Hist. Nat.* lib. xxiv. cap. 40, ed. Valp.
[4] *Hist. Rei Herb.* i. 80.

keel broad; *vexillum* and *alæ* much spreading. *Legumes* large, dark-brown, containing 15 or 16 *seeds*.

Hab.—Indigenous; growing on dry hills and bushy places. Flowers in June.

DESCRIPTION.—Broom-tops (*scoparium; cacumina scoparii*) have a bitter, nauseous taste, and, if fresh, a remarkable odour when bruised.

COMPOSITION.—The *flowers* of broom contain, according to Cadet de Gassicourt,[5] *concrete volatile oil, fatty matter, wax chlorophylle, yellow colouring matter, tannin, a sweet substance, mucilage, osmazome, albumen,* and *woody fibre.* The *ashes* amounted to 5·75 per cent., and contained 29 per cent. of carbonate of potash, besides chloride of potassium, sulphate of potash, chloride of calcium, nitrate, phosphate, and sulphate of lime, carbonates of lime, magnesia, and iron, and silica.—*Salt of broom*, or *sal genistæ*, is obtained by burning the whole plant. It contains a large portion of carbonate of potash. Hill[2] says, that a pound of the green twigs, with the leaves and flowers, yields a drachm and a half of this salt.

[Dr. Stenhouse has separated, as he believes, the diuretic principle of the broom, and has tried its effects upon dogs and rabbits. When quite pure it is a yellow substance, and crystallises in needles. This chemist found that the narcotic principle of broom is a volatile base, represented by the formula $C^{15}H^{13}N$. It is not quite so poisonous as conia or nicotine, but it produces in small doses a species of violent intoxication, followed by a profound slumber, from which the animal cannot be roused for a long time without great difficulty. To this base he gives the name of *Spartiine*.

The term *Scoparine* is applied by Dr. Stenhouse to a green gelatinous matter, which is formed in a concentrated watery extract of broom, after it has stood for one or two days in a cold place. Scoparine has no taste, and does not appear to be at all poisonous or injurious. The dose of scoparine required to produce a decidedly diuretic effect is five grains, repeated three times at intervals of three hours. *Spartiine* and its salts have an intensely bitter taste. The carbazotate cannot be distinguished from carbazotate of potash.—ED.]

PHYSIOLOGICAL EFFECTS. α. *On Animals generally.*—In some parts of Europe broom is employed as winter food for sheep; and Withering says that it prevents the disease called rot, and is salutary in dropsy, to which sheep are liable. According to Loudon, it is apt to produce disease of the urinary organs, to prevent which a plentiful use of water is recommended.

β. *On Man.*—*In large doses* broom-tops are an emetic and purgative. *In small doses* they are diuretic and mildly laxative. As a diuretic they have been celebrated by Mead and Cullen.—"Though very little in use," says Dr. Cullen,[3] "I have inserted this in my catalogue from my own experience of it. I found it first in use among our common people; but I have since prescribed it to some of my patients in the manner

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[1] *Journ. de Pharm.* x. 448.

[2] *Hist. of the Mat. Med.* 397.

[3] *Mat. Med.*

following:—I order half an ounce of fresh broom-tops to be boiled in a pound of water till one-half of this is consumed; and of this decoction I give two table-spoonfuls every hour, till it operates by stool and urine; and by repeating this exhibition every day, some dropsies have been cured." Having very frequently employed broom in dropsies, I can add my testimony to its powerful effects as a diuretic. I cannot call to mind a single case in which it has failed to act on the kidneys. In some cases it produced a most marked and beneficial effect on the dropsical effusion. According to my experience, it is more certain than any other diuretic in dropsies. Dr. Pearson[1] terms broom a *tonico-diuretic;* and says it improves the appetite, and invigorates the whole system.

USES.—It has been principally or solely employed in dropsies, and, as already mentioned, sometimes with great benefit. Of course its chance of cure depends on the nature of the cause of the dropsical effusion. In acute inflammatory cases, as well as in diseased kidney, its use might be objectionable. It is said also not to be adapted to thoracic dropsy, especially when combined with pulmonary congestion, or any degree of inflammatory affection of the chest.

ADMINISTRATION.—Broom-tops are usually given in the form of *infusion* or *decoction.* The *seeds,* which keep much better than the tops, and on that account have an advantage over the latter, may be used in the form of powder, in doses of grs. x. to grs. xv. in mint water or cold ginger tea; or in the form of tincture (see *Spartium junceum.*) To promote the operation of broom, diluents should be freely used.

DECOCTUM SCOPARII COMPOSITUM, L.; *Decoctum Scoparii,* E. D.; *Decoction of Broom.* (Broom-tops, Juniper Berries, Dandelion Root, of each ℥ss.; Distilled Water, Oiss. Boil down to a pint, and strain, *L.*—Broom-tops, and Juniper-tops, of each ℥ss.; Bitartrate of Potash, ʒiiss.; Water, Oiss. Boil them down together to a pint, and then strain, *E.*—Broom-tops dried, ℥ss.; Water, Oss. Boil for ten minutes in a covered vessel, and strain. The product should measure about ℥viij., *D.*)—Diuretic and laxative.—Dose f℥j. to f℥ij.

282. GLYCYRRHIZA GLABRA, *Linn. L. E. D.*—COMMON LIQUORICE.

Sex. Syst. Diadelphia Decandria.

(Radix recens et exsiccata, *L.*—Root; Extract of the root, *E.*—Radix, *D.*)

HISTORY.—The γλυκύῤῥιζα of Hippocrates, and that of Dioscorides,[2] are doubtless identical; the latter is supposed by Sprengel[3] and others to be our *Glycyrrhiza glabra;* by Dierbach[4] to be *G. glandulifera,* but by Dr. Sibthorp[4] it is said to be the *G. echinata,* which is now termed in

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[1] *Observ. on Broom-seed,* 1835.

[2] Lib. iii. cap. 7.

[3] *Hist. Rei Herb.* i.

[4] *Arzneim. d. Hippokrates.*

[5] *Prodr. Fl. Græcæ,* ii. 77.

Greece γλυκόριζα. *Glycyrrhiza glabra* is called, in the *Pharmacopœia Græca*, γλυκύῤῥιζα.

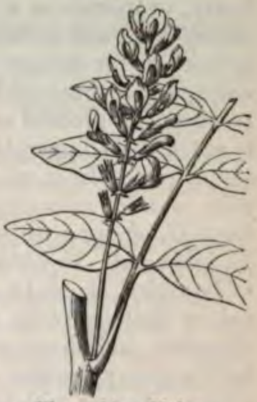
BOTANY. **Gen. Char.**—*Calyx* naked, tubular, 5-cleft, 2-lipped; with the two upper lobes united more than the others. *Verillum* ovate-lanceolate, straight; *keel* 2-parted or 2-petalous, straight, acute. *Stamens* diadelphous. *Style* filiform. *Legume* ovate or oblong, compressed, 1-celled, 1- to 4-seeded.—Perennial *herbs* with extremely sweet *roots*. *Leaves* unequally pinnated. *Racemes* axillary. *Flowers* blue, violet, or white (De Cand.)

Sp. Char.—*Leaflets* ovate, slightly retuse, viscid beneath. *Stipules* 0. *Spikes* pedunculated [i. e. *racemes*], shorter than the leaves. *Flowers* distant. *Legumes* smooth, 3- or 4-seeded (De Cand.)

Stem erect, smooth, 4 or 5 feet high. *Leaflets* yellowish-green. *Flowers* papilionaceous, bluish or purplish.

Hab.—South of Europe. Cultivated at Mitcham in Surrey, and at other places, for medicinal use.

FIG. 57.



Glycyrrhiza Glabra.

DESCRIPTION.—The underground stem is denominated *liquorice-root* (*radix glycyrrhizæ* seu *liquiritiæ* vel *liquoricæ*) or *stick liquorice.* It is in long cylindrical pieces, about the thickness of the finger. Externally it is greyish brown, internally yellow. Its odour is rather sickly and earthy: its taste remarkably sweet.

COMMERCE.—Liquorice root (*G. glabra*) was analysed by Robiquet in 1809.[1] Trommsdorff[2] analysed the root of *G. echinata.* The constituents of the fresh root of *G. glabra* are, according to Robiquet, *glycyrrhizin, starch, asparagin, resinous oil, albumen, woody fibre, and salts* (phosphate and malate of lime and magnesia).

1. GLYCYRRHIZIN (*Glycion* or *Liquorice Sugar*).—Belongs to the uncrystallisable sugars which are not susceptible of vinous fermentation. It is characterised by its affinity for acids, with which it unites to form compounds which are very slightly soluble only in water. It is yellow and transparent, and has the sweet taste of the root. It is soluble in both water and alcohol. Acids precipitate it from its solution. It combines also with bases, as well as with salts. It causes precipitates with many metallic solutions.

RESINOUS OIL.—To this constituent, liquorice root owes the slight degree of acridity which it possesses.

PHYSIOLOGICAL EFFECTS.—Liquorice root and its extract are emollient, demulcent, and nutritive.

USES.—Employed as an emollient and demulcent in catarrhal affections of the mucous membranes. It is also used as a flavouring adjunct to other medicines. Its powder is employed in the preparation of pills, either to give them a proper consistence, or to prevent their adhesion.

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[1] *Ann. de Chim.* lxxii. 143.

[2] Gmelin, *Handb. d. Chem.* ii. 1261.

ADMINISTRATION.—For medicinal use the root should be *decorticated*, as the epidermis possesses a slight degree of acridity.

1. EXTRACTUM GLYCYRRHIZÆ, L. E. D.; *Extract of Liquorice.* (Of recent Liquorice-root bruised, lb. iiss; boiling Distilled Water, Cong. ij.; macerate 24 hours, then boil to a gallon, and strain the liquor while hot; lastly, evaporate to a proper consistence, *L.*)—(Liquorice-root in thin slices, dried and reduced to coarse powder, lb. j.; Distilled water, Oiij.; proceed as for extract of Gentian, *D.*)—(Cut Liquorice-root into small chips, dry it thoroughly with a gentle heat, reduce it to a moderately fine powder, and proceed as for extract of Gentian, *E.*)—Extract of liquorice is extensively imported under the name of *liquorice juice*, or, according to the countries from where it is brought, *Spanish* or *Italian juice*. *Solazzi juice* is most esteemed. The Spanish extract is prepared in Catalonia from *G. glabra;* while the Italian extract is obtained in Calabria from *G. echinata.*[1] In 1839 there were imported 4059 cwts. of foreign extract of liquorice, the duty on which is £3 15s. per cwt. It comes in cylindrical or flattened rolls of five or six inches long, and about one inch in diameter, and enveloped in bay leaves. When pure it is black and dry, with a glossy fracture and a sweetish taste; and is completely soluble in water. As met with in commerce, however, it is rarely pure. Neumann[2] obtained 460 parts of watery extract from 480 of Spanish liquorice. It contains the soluble principles of the root, with some copper scraped off the boiler by the spatula employed to stir the extract during its preparation. Fée says, that four ounces of this extract yield two drachms and a half of metallic copper; but there must be some great mistake in this statement. If the foreign extract be dissolved in water, and the solution filtered and inspissated, we obtain *refined liquorice.* But I am informed that the *pipe refined liquorice* of the shops is a very adulterated article. The *Pontefract lozenges* are made of refined liquorice, and are much esteemed. Another preparation has been recently introduced under the name of *quintessence of liquorice.* Extract of liquorice is dissolved slowly in the mouth, to appease tickling cough. It is a very agreeable flavouring adjunct to other medicines. As it easily becomes soft by warmth it does not answer well as a pill-basis.

2. TROCHISCI GLYCYRRHIZÆ, E.; *Liquorice Lozenges.* (Extract of Liquorice; Gum Arabic, of each ℥vj.; Pure Sugar, lb. i. Dissolve them in a sufficiency of boiling water; and then concentrate the solution over the vapour-bath to a proper consistence for making lozenges).—Employed in tickling cough and irritation of the fauces.

[**3. TROCHISCI GLYCYRRHIZÆ ET OPII**, U. S.; *Troches of Liquorice and Opium.* Take of opium in powder half an ounce; Liquorice in powder, Sugar in powder, Gum Arabic in powder, each ten ounces; Oil of Anise, two fluidrachms. Mix the powders intimately, then add the oil of anise, and with water form them into a mass to be divided into troches each weighing six grains. Employed in coughs and catarrhs, under the name of Westor's Cough Lozenges. Two or three are the dose.—ED.]

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[1] Fée, *Cours d'Hist. Nat.* ii. 24.

[2] *Works*, by Lewis, p. 425.

283. ASTRAGALUS, *De Candolle.*—MILK VETCH.

A. verus, Olivier, *L.*—*A. gummifer*, and probably *A. verus*, and other species, *E.*—*A. gummifer* (Labillardière), *D.*

Sex. Syst. Diadelphia Decandria.

(Succus e cortice exudatus āere induratus, *L.*—Gummy exudation, *E. D.*)

HISTORY.—Dr. Sibthorp[1] states that the *τραγάκανθα* of Dioscorides[2] is the *Astragalus aristatus*, which in the Peloponnesus is still called *τραγάκανθα*, and whose gum is annually sent to Italy.

BOTANY. **Gen. Char.**—*Calyx* 5-toothed. *Corolla* with an obtuse keel. *Stamens* diadelphous. *Legume* 2-celled, or half 2-celled, by the lower [dorsal] suture being turned inwards.—*Herbs* or *shrubs* (De Cand.).

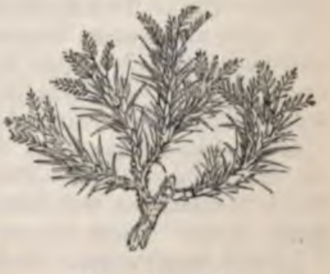
Species 1. A. VERUS, L. E.—*Flowers* axillary, in clusters of 2 to 5 sessile. *Calyx* tomentose, obtusely 5-toothed. *Leaflets* 8 to 9 pairs, linear, hispid (De Cand.)—A small *shrub*. *Branches* covered with imbricated scales and spines, the remains of former petioles. *Flowers* yellow, papilionaceous. Persia. According to Olivier the Tragacanth of Asia Minor, Armenia, and Northern Persia, forming the greater part of that of Europe, is yielded by this species.

2. A. GUMMIFER, D.—*Flowers* 3 to 5 axillary, sessile. *Calyx* 5-cleft, together with the legumes woolly. *Leaflets* 4 to 6 pairs, oblong-linear, smooth (De Cand.)—Lebanon. According to Labillardière this species yields Tragacanth (De Cand.) Dr. Lindley[3] received this plant from Mr. Brant, English Consul at Erzeroum, as the tragacanth plant of Koordistan, which yields the white or best kind of tragacanth.

3. A. CRETICUS.—*Flowers* axillary, sessile, clustered. *Calyx* 5-partite, with feathery setaceous lobes rather longer than the corolla. *Leaflets* 5 to 8 pairs, oblong, acute, tomentose (De Cand.)—Mount Ida, in Crete, where it yields Tragacanth, according to Tournefort.

4. A. STROBILIFERUS, Lindley.—*Flowers* capitate in an ovate, sessile, axillary strobile. *Bracts* imbricated, pointletted, tomentose. *Calyx* feathery, 5-cleft. Segments of the *Corolla* equal. *Leaflets* 3-paired, woolly, oval, awned at the apex, narrow at the base (Lindley).—Koordistan.—This plant was sent by Mr. Brant as the "shrub from which the red or inferior species of gum tragacanth is produced."[4]

FIG. 58.



Astragalus creticus.

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[1] *Prodr. Fl. Græc.* ii. 90.

[2] Lib. iii. cap. 23.

[3] *Botanical Register*, May 1840.

[4] *Ibid.* Miscellaneous Notices, p. 38.

PRODUCTION. — Tragacanth is a natural exudation from the stem of the before-mentioned plants. The cause of the exudation of this as of other gums is thus explained by De Candolle.[1] The gummy matter resides in the bark and albumen; it is the nutritive juice of the plant; and its escape, therefore, is analogous to hemorrhage in animals: hence plants in which it spontaneously occurs are always in a sickly state. The mechanical cause of the expulsion of this juice is dependent on the unequal hygrometric properties of the different parts of the stem. The wood absorbs more moisture from the air than the bark, and hence it swells more. In consequence of its enlargement, it distends the bark, which, by the internal pressure of the wood, gives way, and the gummy matter escapes. This explanation is quite in conformity with facts mentioned by Labillardière,—that tragacanth flows only in abundance during the night, and a little after sunrise. A cloudy night, or a heavy dew, is, he thinks, necessary for its production; for the shepherds of Lebanon only go in search of this substance when the mountain has been covered during the night with thick clouds.

[But Maltass states that Tragacanth is now collected by making longitudinal incisions into the lower part of the stem of the tree during the months of July and August. The gum exudes along the whole length of the incision, and is collected in three or four days time. At the same time the peasants pick off the gum which exudes naturally.

The gum is white and clean when the weather is hot and dry, but if damp it turns of a brownish colour.

The gum is sent to Smyrna in bags of 2 cwt. each, and there sorted into what is called French quality (the best), English quality (a little discoloured), common, and vermicelly or old.[2]—ED.]

DESCRIPTION. — Tragacanth (*gummi tragacantha*) is frequently called in the shops *gum dragon.* — It is white, yellowish, or yellowish-brown, hard, tough, odourless, tasteless, swelling considerably in water, and forming a thick, tenacious mucilage. [Mr. Berkely finds it to consist of globular cells, with a distinct thin wall of cellulose, sometimes marked by concentric lines; in the interior of the cells is often a mass of starch grains.—ED.] Two kinds of it are known.

1. **Flaky Tragacanth:** *Smyrna Tragacanth* (Martius): *Tragacanth of the Astragalus verus?* — This is the tragacanth usually found in English commerce. It occurs in moderately large, broad, thin pieces, marked with arched or concentric elevations.

2. **Vermiform Tragacanth:** *Morea Tragacanth* (Martius): *Tragacanth of the Astragalus creticus?*—This variety is rarely met with in this country, but is common on the continent. It occurs in small, twisted, filiform, spiral pieces. There is more starch in it than in the first variety.

[ADULTERATIONS. — Maltass states that it is principally mixed with gum from other trees collected in Caramania, whence it is called Caramania Gum; that collected in Armenia is called Moussul Gum, from the place of its exportation.[3]—ED.]

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[1] *Phys. Vég.* t. i.
[2] *Pharm. Journal*, xv. 20.
[3] *Ibid.*

COMMERCE.—Tragacanth is imported in cases and chests from Smyrna and other ports of the Levant. In 1836, duty (6*s.* per cwt.) was paid on 87 cwts.

COMPOSITION.—The *ultimate* analysis of tragacanth has been made by Hermann and by Guerin-Varry.[1]

	Hermann's Analysis.			*Guerin-Varry's Analysis.*	
	Atoms.	*Eq. Wt.*	*Per Cent.*	*Soluble part.*	*Insoluble ditto.*
Carbon	10	60	40·50	42·01	35·79
Hydrogen	10	10	6·61	6·42	7·11
Oxygen	10	80	52·89	54·47	57·10
Tragacanth gum	1	150	100·00	103·00	100·00

In 1805, Vauquelin[2] made an examination of the *proximate* constituents of tragacanth. In 1815, Bucholz[3], and in 1831, Guerin-Varry[4], published proximate analyses of this gum.

Bucholz's Analysis.	
Common gum	57
Bassorin	43
Gum Tragacanth	100

Guerin-Varry's Analysis.	
Arabin	53·30
Bassorin and starch	33·10
Water	11·10
Ashes	2·50
Gum Tragacanth	100·00

1. TRAGACANTHIN.—*Adragantin; Soluble gum* or *Arabin* of Tragacanth.—The soluble gum of tragacanth is usually regarded as similar to gum Arabic, and hence it is called arabine; but is distinguished by silicate of potash and perchloride of iron producing no change in it, and by a peculiar appearance of the precipitate produced with alcohol (the precipitate is flocculent, and collects in a similar opaque and mucous mass).—In common with arabine, it produces precipitates with diacetate of lead, protochloride of tin, and protonitrate of mercury. Oxalate of ammonia detects in it a calcareous salt.

2. BASSORIN.—*Insoluble gum of Tragacanth.*—The insoluble part of gum tragacanth is similar to that of gum Bassora, and hence it is called *Bassorin.* It swells up in water.

3. STARCH.—Starch globules may be detected in the bassorin (when swollen up by water) both by the microscope and by iodine.

According to Guibourt[5] tragacanth contains neither arabin nor bassorin, but is essentially formed by an organised gelatiniform matter, very different from gum Arabic both in its physical and chemical properties, and which swells and divides in water, so as in part to pass through a filter. The insoluble part of tragacanth is, according to the same authority, a mixture of starch and lignin, which has nothing in common with bassorin. De Candolle suggests that the insolubility and swelling of tragacanth in water may arise from the gummy matter being contained in cells.

PHYSIOLOGICAL EFFECTS.—Like other gums, tragacanth is emollient, demulcent, and nutritive; but difficult of digestion.

USES.—Tragacanth, in powder, is used rather as a vehicle for active and heavy medicines (as calomel), than on account of its own proper effects. It is occasionally, however, taken as a sheathing or demulcent agent in irritation of the mucous membranes.

ADMINISTRATION.—Dose of the powder, ʒss. to ʒij.

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[1] *Journ. de Chim. Méd.* vii. 742.

[2] *Ann. de Chim.* liv. 312.

[3] Gmelin, *Handb. d. Chem.* ii. 779.

[4] *Op. supra cit.*

[5] *Hist. des Drog.* ii. 477.

1. **PULVIS TRAGACANTHÆ COMPOSITUS**, L. E.; *Compound Powder of Tragacanth.* (Tragacanth, bruised; Gum Arabic, bruised; Starch, of each, ℥iss.; Pure Sugar, ℥iij. Rub the Starch and Sugar together to powder, then having added the Tragacanth and Gum Arabic, mix them together.)—Employed as a vehicle for the exhibition of active and heavy powders to children.—Dose for an adult, ʒss. to ʒj.

2. **MUCILAGO TRAGACANTHÆ**, E.—(Tragacanth, ʒij.; Boiling Water, f℥ix.) "Macerate for twenty-four hours, then triturate to dissolve the gum, and express through linen or calico," *E.*—Employed in making pills and lozenges; also to suspend heavy powders, as the metallic oxides, in water. It has also been recommended as an application to burns.

284. MUCUNA PRURIENS, *De Candolle, L. E.*—COMMON COWHAGE, OR COW-ITCH.

Dolichos pruriens, *Linn. D.*—Stizolobium pruriens, *Persoon.*
Sex. Syst. Diadelphia Decandria.
(Fructûs pubes, *L.*—Hairs from the pod, *E.*—The hairy down of the pod, *D.*)

HISTORY.—One of the earliest writers who mention this plant is Ray.[1] It was long confounded with the *M. prurita*, Hooker.

BOTANY. **Gen. Char.**—*Calyx* campanulate, 2-lipped; the lower lip trifid, with acute segments, the middle one the longest; the upper lip broader, entire, obtuse. *Vexillum* ascending, shorter than the alæ and keel; *alæ* oblong, as long as the keel; *keel* oblong, straight, acute. *Stamens* diadelphous; *anthers* 10, of which 5 are oblong-linear and 5 ovate, hirsute. *Legume* oblong, knotted, 2-valved, with cellular partitions. *Seeds* roundish, surrounded by a circularly linear hilum.—Twining *herbs* or *shrubs*. *Leaves* pinnately trifoliate. *Racemes* axillary. *Legumes* usually hispid and stinging, by the innumerable very brittle hairs which readily penetrate the skin (De Cand.)

Sp. Char.—*Flowers* in racemes. *Legumes* stinging, with somewhat keeled valves. *Leaflets* hairy beneath, acuminate; the middle one rhomboidal, the lateral ones dilated externally (De Cand.)—*Root* perennial. *Stem* herbaceous. *Flowers* with a disagreeable alliaceous odour; *vexillum* flesh-coloured; *alæ* purple or violet; *keel* greenish-white.

Hab.—West Indies.

MUCUNA PRURITA, Hooker.[2]—A native of the East Indies; has been usually confounded with the American *M. pruriens;* but is distinguished by its smaller leaves, its more obtuse (not acuminated) *leaflets*, the middle one being more truly rhomboidal; its *flowers* more constantly in threes, and by its *legumes* being greatly broader, compressed, free from any raised line on the back of the valve; whilst in the American *M. pruriens* the pods are much narrower, terete, and keeled on the valves.

DESCRIPTION.—*Cowhage* or *Cow-itch* (*siliqua hirsuta*) is the legume of the Mucuna pruriens (*legumen mucunæ, stizolobii*, vel *dolichos pru-*

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[1] *Hist. Plant.* i. 887.
[2] *Bot. Miscell.* ii. 348.

rientis). It is of a brownish colour, is shaped like the letter *f*, about four or five inches long, contains from four to six seeds, and is clothed with strong, brown, bristly, stinging hairs (*pubes leguminis; setæ siliquæ hirsutæ*), which, examined by the microscope, appear like porcupines' quills, but are slightly notched or serrated towards the point.

COMPOSITION. — The hairs contain tannic acid.[1]

PHYSIOLOGICAL EFFECTS.—A decoction of the root or of the legumes is said to be diuretic, and was formerly used in dropsy.[2] The setæ applied to the skin produce intolerable itching, and, in some persons, pain, redness, swelling, and even an eruption. These effects, which are increased by rubbing, but diminished by the application of oil, are referrible to the mechanical properties of the setæ.

USES. — The setæ have been celebrated for their anthelmintic properties. Their action is supposed to be mechanical; that is, they are supposed to pierce and torment intestinal worms, and thereby to oblige them to let go their hold. In support of this explanation, Mr. Chamberlaine[3] tells us he sprinkled some of the hairs in a calabash full of very large round worms (*Ascaris lumbricoides*), and that in a little time the animals began to writhe and twist about, evincing thereby extreme torture. On examining them with a magnifying glass, the hairs were found sticking loosely in various parts of their bodies. Their usual want of action on the internal coat of the intestines is ascribed to the mucous secretion which defends the subjacent membrane from injury. In one case diarrhœa followed the use of a very large dose of the electuary, and in another instance enteritis came on, after taking this preparation once; but it is not certain that these were the consequences of the operation of the hairs.[4]

Cowhage has been principally celebrated for expelling the large round worm (*Ascaris lumbricoides*), and the small thread-worm (*A. vermicularis*). It has not proved equally serviceable against the tape-worm (*Tænia solium*).

ADMINISTRATION. — The best mode of exhibiting the setæ is in treacle, syrup, or honey. The quantity of hairs should be sufficient to give the syrup, or treacle, the consistence of honey, or of an electuary; and of this mixture a tea-spoonful may be given to children, and a table-spoonful to adults: this dose should be taken twice a day—namely, at going to bed, and in the morning an hour before breakfast. Chamberlaine says it usually operates more effectually where a gentle emetic has been premised. After continuing the electuary for three or four days, a brisk purgative of jalap, or senna, should be taken, which will in general bring away the worms.

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[1] Martius, *Pharmakogn.*

[2] Browne, *Jamaica*, p. 291.

[3] *Pract. Treat. on Stizolobium, or Cowhage*, p. 57, 9th edit. 1804.

[4] Chamberlaine, *op. cit.* p. 65.

285. PTEROCARPUS SANTALINUS, *Linn. L. E.*—THREE-LEAVED PTEROCARPUS.

Sex. Syst. Diadelphia Decandria.
(Lignum, *L.*—Wood, *E.*)

HISTORY.—Avicenna[1] mentions red sandal wood (*sandalus rubens*). Garcias[2] thinks the term *sandal* is a corruption of *chandama*, the name by which the wood is known in Timor.

BOTANY. **Gen. Char.**—*Sepals* 5, cohering to form a 5-toothed calyx. *Petals* 5, forming a papilionaceous corolla. *Stamens* 10; the *filaments* variously combined. *Legume* indehiscent, irregular, somewhat orbicular, surrounded by a wing, often varicose, 1-seeded. *Cotyledons* thick, incurved; *radicle* somewhat inflexed at the base of the embryo.—Unarmed *trees* or *shrubs*. *Leaves* unequally pinnated (De Cand.)

Sp. Char.—Arboreous. *Leaflets* 3 (rarely 4 or 5?), roundish, retuse, glabrous. *Racemes* axillary, simple or branched. *Petals* long-clawed, all waved or curled on the margins. *Stamens* combined into a sheath, split down to the base on the upper side, and half way down on the lower. *Legume* long-stalked, surrounded by a broad, membranous wing, obtuse at the base, 1- or rarely 2-seeded (Wight and Arnot).

A lofty *tree*. *Flowers* yellow, with red veins.

Hab.—Mountains of Coromandel and Ceylon.

DESCRIPTION.—*Red Sandal* or *red Sander's wood* (*lignum santali rubri; lignum santalinum rubrum*) is imported in roundish or somewhat angular billets, which are blackish externally, but of a blood-red internally. It is compact, heavy, of a fibrous texture, but is capable of taking a fine polish; almost tasteless, and inodorous, except when rubbed, when it emits a feeble smell. It scarcely communicates colour to water. Alcohol, as well as alkaline solutions, readily extract the colouring matter. The alkaline solution is violet-red, and forms a precipitate (*santalin*) on the addition of acids. The alcoholic solution produces precipitates with several metallic solutions: thus, violet with solutions of lead, scarlet with corrosive sublimate, and deep violet with sulphate of iron.

COMPOSITION.—Red sandal wood was analysed by Pelletier,[3] who found in it a *peculiar colouring matter*, which he called *santalin* (about 16·75 per cent.), *extractive*, *gallic acid*, and *woody fibre*.

SANTALIN is dark red, with a resinous appearance; almost insoluble in water, but soluble in alcohol, alkaline solutions, ether, acetic acid, and slightly so in some of the volatile oils (as the oils of lavender and rosemary). The effects produced on its alcoholic and alkaline solutions by salts, &c. are similar to those above mentioned on the tincture of the wood. The composition of santalin is, *carbon* 75·03, *hydrogen* 6·37, *oxygen* 18·6; or $C^{16}H^{8}O^{3}$.

USES.—It is employed in medicine as a colouring agent. (See *Tinctura Lavandulæ composita.*)

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[1] *Canon.* lib. ii. tract ii. cap. 656.
[2] Clusius, *Exot.* 173.
[3] *Journ. Phys.* lxxix. 268.

286. PTEROCARPUS (*Marsupium*, L. Roxb.), ERINACEUS, *Lamarck*, *D. E.*—THE INDIAN KINO-TREE.

Sex. Syst. Diadelphia Decandria.

(Succus ex inciso cortice fusus, sole induratus, *L.*—Kino Indicum; Concrete exudation of this and other undetermined genera and species, *E.*—Kino [plant yielding it unnamed], *D.*

HISTORY.—In 1757 Dr. Fothergill[1] described an astringent gum, which he supposed (though on very loose evidence) to have been brought from the river Gambia; and hence he termed it *Gummi rubrum astringens gambiense.* In 1774 it was introduced into the Edinburgh Pharmacopœia as *Gummi kino;* and in 1787 into the London Pharmacopœia as *Resina kino.* It was described under this designation in the 3d edition of Lewis's *Exp. Hist. of the Mat. Med.*, by Dr. Aikin, in 1784. In 1794 Schenck[2] published an inaugural dissertation on it. I have not been able to ascertain why it was called kino; nor can the precise nature of the substance referred to be now ascertained. Several years since I accidentally found, in the warehouse of an old drug firm in London, a substance marked *Gummi rubrum astringens,* which I was told had formerly fetched a very high price. It has subsequently proved to be *Butea gum.* I was at first inclined to believe that it was the original astringent gum of Fothergill, and it has been described by Professor Guibourt[3] as *gomme astringente de Gambie.* But a more attentive perusal of Dr. Fothergill's paper has led me to doubt their identity (see *Butea gum*). It is somewhat remarkable, however, that the Hindu name for Butea gum is *kueni* or *kuenee,* from which the European term *kino* may probably be derived.

BOTANY. **Gen. Char.**—See *Pterocarpus santalinus.*

Sp. Char.—*Stamens* monadelphous. *Leaflets* 5-7, alternate, elliptical, rather emarginate, leathery, smooth. *Branches* and *calyxes* smooth. *Panicle* terminal. *Pod* half-circular, oblique, smooth.—A *tree.*

Hab.—Malabar.

EXTRACTION OF THE JUICE OF PTEROCARPUS ERINACEUS.—"When an incision is made" in the trunk and branches of the tree, "the juice flows out, at first of an extremely pale-red colour, and in a very liquid state; but it soon coagulates, becoming of a deep blood-red hue, and so remarkably brittle, that its collection is attended with some difficulty."[4] [It is obtained in the months of April and March by making transverse incisions in the bark of moderately-sized trees.[5]—ED.]

1. KINO OF COMMERCE.—Two substances are met with in English commerce under the name of kino,—one called *Botany Bay Kino,* which is the inspissated juice of the *Eucalyptus resinifera* (before described), the other, apparently an extract, imported from Bombay and Tellicherry, and which may be termed *East Indian Kino*. The latter is presumed to be the substance referred to in the British pharmacopœias, as it is always regarded in commerce as *genuine gum kino*. It is imported in boxes, chiefly from Bombay or Tellicherry.

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[1] *Med. Obs. and Inq.* i. 358, 4th edit. 1776.

[2] *Coll. Diss. med. Marburg,* t. v.

[3] *Hist. des Drog.* ii. 428, 3me édit.

[4] Gray, *Trav. in Western Africa,* in Stevenson and Churchill's *Med. Bot.*

[5] *Pharm. Journal,* xiv. 61.

The author states that in his museum he had several other substances, apparently extracts, which he had received as *kino*, mostly from Professor Guibourt, who has described several of them in his *Hist. des Drog*. ii. 428. One of these is, perhaps, *Jamaica kino*. A second he received as *Colombian kino*. A third he believed to be *foreign extract of rhatany*. He had never met with them in English commerce, and therefore thought it needless to describe them.

DESCRIPTION.—*East Indian kino* (*kino indicum* seu *ostindicum*), sometimes called *Amboyna kino* (*kino amboinense*), and usually known in the shops as *gum kino* (*kino*, Ph. L. E. D.), occurs in small, angular, glistening fragments, the larger of which appear almost black, the smaller being reddish. When entire they are opaque, but in thin laminæ are transparent and ruby-red. They are brittle between the fingers, soften in the mouth, stick to the teeth, and colour the saliva red. They are inodorous, but have a very astringent taste. Both water and alcohol acquire, by digestion on kino, a deep red colour. The aqueous decoction becomes turbid on cooling. [Its solution in alcohol has an acid reaction; it is quite insoluble in ether.[1]—ED.] The mineral acids and solutions of gelatine, emetic tartar, acetate of lead, sesquichloride of iron, and nitrate of silver, produce precipitates with the watery infusion.

In the former edition of this work the tree yielding East Indian kino was said to be unascertained; but that it was probable a native of the Malabar coast, for all the importations of the East Indian kino which I had traced were from Bombay or Tellicherry. An experienced East India broker had assured me it was the produce of the Malabar coast. As Pterocarpus erinaceus is not known to grow in India, there is no ground for ascribing East Indian kino to that species. The London College has now made kino the produce of Pterocarpus marsupium, which Dr. Roxburgh[2] says yields an astringent inspissated juice exceedingly like Butea gum. I am indebted to Mr. Edward Solly for a sample of extract of Pterocarpus marsupium, which he received from Dr. Gibson. It is a dark red, tenacious, acidulous, moderately astringent substance. It differs, therefore, from the gummy resin which Dr. Roxburgh describes as being the product of this tree. This accurate naturalist describes it as being very brittle, and having a strong, but simply astringent taste; characters which apply to East Indian kino.

COMPOSITION.—East Indian kino was analysed by Vauquelin,[3] who found its constituents to be as follows:—*tannin* and *peculiar extractive* 75, *red gum* 24, *insoluble matter* 1. A. W. Buchner[4] has subsequently shown that *catechine* is a constituent of kino. To this substance, which has been before noticed, kino owes its power of communicating a green colour to the salts of iron. [Henning[1] finds kino to be composed of the following constituents in the order in which they are here placed.

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[1] *Pharm. Journ.* xiii. p. 77.

[2] *Fl. Ind.* iii. 235.

[3] *Ann. de Chim.* xlvi. 321.

[4] *Pharm. Central-Blatt. für* 1833, S. 629 and 652.

Kinoic acid.
Tannic acid.
Pectin.
Ulmic acid.
Inorganic salts with excess of earthy bases.

The salts are principally phosphate of soda, and of magnesia, and carbonate and sulphate of lime.

The kinoic acid is of a red colour, more readily soluble in alcohol than in cold water; it gives a yellowish precipitate with perchloride of iron and a brownish one with acetate of lead.

Henning further expresses an opinion that catechine is not found in true kino, but only in drugs which, though varieties of catechu, are frequently confounded with the former.—ED.]

PHYSIOLOGICAL EFFECTS.—Astringent. Less effective, and less readily dissolved in the alimentary juices, than catechu, to which in its operation it is closely allied.

USES.—Employed in medicine as an astringent only; principally in obstinate chronic *diarrhœa*. In this disease it is usually given in combination with chalk, and frequently with opium. In *pyrosis* the compound powder of kino (*i. e.* opium and kino) has been found serviceable. Dr. Pemberton[2] ascribes to kino a power of restraining the discharge of the mucous glands of the intestinal canal when they are secreting too much, and of contracting vessels already too much relaxed, without exerting any such power over the glands and vessels when they are acting naturally. It has been administered as an astringent in *leucorrhœa* and *sanguineous exhalations*, and as a tonic in *intermittents*. As a topical astringent it has been applied to flabby ulcers, and used as a gargle, injection, and wash.

ADMINISTRATION.—The dose of the powder is grs. x. to ʒss.

2. **TINCTURA KINO**, L. E.; *Tincture of Kino.* (Kino, bruised, ℥iiiss.; Rectified Spirit, Oij. Digest for seven days, and strain. "This tincture cannot be conveniently prepared by the process of percolation;" *E.*)—Astringent. Used in diarrhœa and hemorrhages, generally as an adjunct to the chalk mixture. Dose, fʒj. to fʒij.—It is said that by keeping this tincture has in some instances become gelatinous, and lost its astringency. Where this occurred probably the *Botany Bay kino* (inspissated juice of the *Eucalyptus resinifera*) had been employed.

3. **PULVIS KINO COMPOSITUS**, L.; *Compound Powder of Kino.* (Kino, ʒxv.; Cinnamon, ℥ss.; Dried Opium, ʒj. Rub them separately to a very fine powder; then mix them.)—Twenty grains of this powder contain one grain of opium. This powder is employed as an astringent in chronic diarrhœa and pyrosis. The dose of it is grs. v. to ℈j.

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[1] *Pharm. Journal*, xiii. p. 78.

[2] *Diseases of the Abdom. Viscera.*

287. ANDIRA INERMIS, *Kunth.*—THE CABBAGE-BARK TREE.

Geoffroya inermis, *Swartz.*
Sex. Syst. Diadelphia Decandria.

HISTORY.—The medicinal properties of the bark of this tree were first pointed out by Mr. Dugald.[1] The first botanical description of the tree was published by Dr. Wright.[2]

BOTANY. **Gen. Char.**—*Calyx* turbinate-campanulate, 5-toothed; teeth almost equal, acute, erect. *Corolla* papilionaceous; the vexillum roundish, emarginate, larger than the keel. *Stamens* diadelphous (9 and 1). *Ovary* containing 3 ovules. *Legume* stalked, somewhat orbicular, rather hard, 1-celled, 1-seeded; when ripe divisible into two valves, according to Swartz (De Cand.)

Sp. Char.—*Leaflets* 13 to 15, ovate-lanceolate, acute, smooth on both sides. *Flowers* paniculate, with very short pedicels. *Calyx* urceolate, ferruginous-pubescent (De Cand.)

Tree of considerable height. *Leaves* pinnate. *Flowers* reddish-lilac.

Hab.—West Indies.

DESCRIPTION.—*Cabbage bark* or *Worm bark* (*cortex andiræ inermis,* seu *geoffroyæ jamaicensis*) occurs in long, thick, fibrous pieces, having a brownish-ash colour, a resinous fracture, a disagreeable smell, and a sweetish, mucilaginous, bitter taste.

SURINAM BARK (*cortex geoffroyæ Surinamensis*) is the bark of *Andira retusa*, var. β. *Surinamensis*, De Candolle. Huttenschmidt[3] found in it a white crystalline substance, which he called *Surinamin*. Surinam bark has been used as a vermifuge, but I am totally unacquainted with it.[4]

COMPOSITION.—Cabbage-bark was analysed in 1824 by Huttenschmidt,[5] who found in it the following substances:—*Jamaicina, yellow colouring matter, gum,* much *starch, wax, brown resin,* a small quantity of *mouldy matter,* a *nitrogenous substance* soluble in carbonate of soda, *oxalate of lime,* and *woody fibre.*—The *ashes* contained carbonate, phosphate, and sulphate of potash, chloride of potassium, carbonate and phosphate of lime, with magnesia, silica, and oxide of iron.

JAMAICINA is a brownish-yellow, crystalline, fusible, very bitter substance, composed of *carbon, hydrogen, nitrogen,* and *oxygen.* It is soluble in water and alcohol, and possesses alkaline properties. Its watery solution forms, with tincture of nutgalls, a yellow precipitate. Two grains of the acetate of jamaicina given to pigeons and sparrows, caused restlessness and trembling, and in half an hour violent purging.

PHYSIOLOGICAL EFFECTS.—Cathartic, emetic, and narcotic. In doses of thirty or forty grains the powder of this bark purges briskly, like jalap. In larger quantities it causes vomiting, fever, and delirium. Fatal accidents are said to have resulted from its imprudent use.

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[1] *Edinb. Phys. and Lit. Essays,* vol. ii.
[2] *Phil. Trans.* vol. lxvii. part 2, p. 507.
[3] *Op. infra cit.*
[4] Göebel, *Pharm. Waarenk.* i. 201; Murray, *App. Med.* ii. 492.
[5] Gmelin, *Handb. d. Chem.* ii. 1264.

USES.—Formerly employed as an anthelmintic, especially against the large round worm (*Ascaris lumbricoides*), but its use is now obsolete.[1]

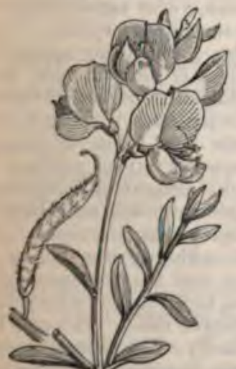
[A formula for a decoction of this bark was given in the old *Dublin Pharmacopœia*, under the name of *Decoctum Geoffroyæ*. It is now, however, erased both from the Materia Medica and the pharmaceutical preparations. According to the plan which we have hitherto pursued, we have allowed the author's description of the Cabbage-bark to remain.—ED.]

ADMINISTRATION.—Dose of the *powder*, ℈j, to ʒss. As an anthelmintic the bark has been given in the form of decoction.

OTHER MEDICINAL PAPILIONACEÆ.

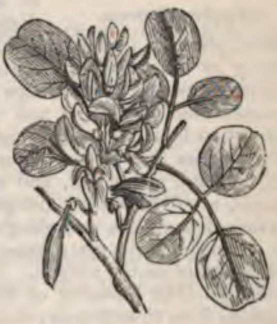
1. **SPARTIUM JUNCEUM**, or *Spanish broom, the σπαρτιον* of Dioscorides, is occasionally employed in medicine. The seeds, in large doses, are emetic and purgative; in small quantities, diuretic. They have been employed by Dr. Eccles[2] in dropsical affections. Their advantage over other diuretics is their tonic operation, in consequence of which they may be persisted in for an indefinite length of time (Pearson). They may be taken, in the form of *powder*, in doses of from grs. x. to grs. xv. three times a-day, in cold ginger-tea or mint-water; but the *tincture* (prepared by digesting ℥ij. of the bruised seeds in f℥viij. of proof spirit) is the best form of exhibition. Its dose is fʒj. to fʒiij.

FIG. 59.



Spartium junceum.

FIG. 60.



Butea frondosa.

2. The **BUTEA FRONDOSA** is a middling-sized tree, common in Bengal and in the mountainous parts of India. "From natural fissures and wounds made in the bark of this tree, during the hot season, there issues a most beautiful red juice, which soon hardens into a ruby coloured, brittle, astringent gum.[3] This is *gum butea*; it has been recently brought over by Mr. Beckett, by whom samples were given to Dr. Royle.[4] On examination I found this gum to be identical with a substance which I had previously met with in an old drug firm of this city, marked *gummi rubrum*

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[1] For further particulars respecting the uses of Cabbage-bark, consult Dr. Wright's paper above referred to.

[2] Pearson, *Observ. on Broomseed*, Lond. 1835.

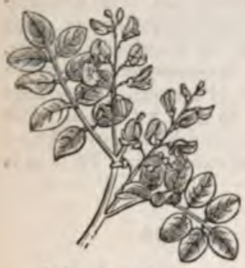
[3] Roxburgh, *Fl. Indica*, iii. 245.

[4] *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 50, Lond. 1838.

astringens, and samples of which I had sent to Professor Guibourt, who has described it under the name of *gomme astringente de Gambie*,[1] believing it to be the kind described by Fothergill.[2] But I have already expressed my opinion that it is not Fothergill's gum. Butea gum (called *Kuenee* in Northern India, and *Kinsuka* in Sanscrit) is in small elongated tears, which are blackish externally, and have pieces of bark adhering to them. Small fragments, examined by transmitted light are observed to be ruby-red. Its taste is astringent. It contains from 15 to 25 per cent. of impurities (wood, bark, small pebbles, and sand). According to Mr. E. Solly, the gum, when purified by simple solution of water, so as to separate the impurities, consists of *tannin* 73·26, *difficultly soluble extractive* 5·05, *gum* (with *gallic acid and other soluble substances*) 21·67. It is used by the natives of North-Western India for precipitating their indigo, and in tanning. English tanners, however, object to its use on account of the colour which it communicates to the leather.[3]

3. INDIGO (*pigmentum indicum*); *ινδικον*, Dioscorides; *indicum*, Pliny) is a blue pigment obtainable from various plants by fermentation. The ancients also applied the term *ινδικον*, or *indicum*, to some other substances.[4] The indigo of commerce is procured from the genus *Indigofera*. In India, *I. tinctoria* is commonly cultivated for this purpose. During the fermentation, the indigo is deposited as a feculent matter. Lime water promotes its separation. Blue indigo does not exist in the plants previous to fermentation: it is, therefore, a product, not an educt of them. Commercial indigo is principally brought from the East Indies, but a considerable quantity is imported from Guatemala, and other places. It usually occurs in cubical cakes of an intense blue colour. Rubbed with a smooth hard body (as the nail), it assumes a coppery or bronze hue. It is insoluble in water, cold alcohol, ether, diluted sulphuric or hydrochloric acids, weak alkaline solutions, and cold oils (both fixed and volatile). When heated to about 550° F. it evolves a reddish, violet vapour (vapour of *indigotin*), which condenses in minute crystals. This distinguishes it from Prussian blue. Deoxidising agents (as protosulphate of iron, sesquisulphuret of arsenic, the process of fermentation, &c.) destroy its blue colour by abstracting oxygen from the indigotin, and converting it into *indigogen*, or *white indigo*; which, by exposure to the air, attracts oxygen, and becomes blue. Chlorine and the hypochlorites destroy the blue colour of indigo. Rubbed with oil of vitriol it yields a deep blue liquid, commonly termed *sulphate of indigo*, *Saxon blue*, or *liquid blue*. Commercial indigo consists of *indigo blue* (indigotin), *indigo brown*, *indigo red*, and *a glutinous substance*. Indigotin consists, according to Dumas, of $C^{16}H^{5}N^{1}O^{2}$. Indigo has, of late years, been employed as a medicine. Its physiological effects, according to Dr. Roth,[5] are as follows:—Shortly after taking it, the patient experiences a sense of constriction at the fauces, and the impression of a metallic taste on the tongue. These are followed by nausea, and frequently by actual vomiting. The intensity of these symptoms varies in different cases. In some the vomiting is so violent as to preclude the further use of the remedy. The matter vomited presents no peculiarity except in its blue colour. When the vomiting has subsided, diarrhœa usually occurs: the stools are more frequent, liquid, and of a blue or blackish colour. The vomiting and diarrhœa are frequently accompanied by cardialgia and colic. Occasionally these symptoms increase, and the use of the remedy is in consequence obliged to be omitted. Dyspepsia and giddiness sometimes succeed. The urine has a brown, dark, violet colour; but Dr. Roth never found the respiratory matter tinged with it. [Dr. Hassal has found indigo in the urine in disease. It is, when first excreted, colourless; but becomes blue on exposure to air. This has happened in cases in which no indigo has been previously administered.[6]—ED.] After the

FIG. 61.



Indigofera tinctoria.

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[1] *Hist. des Drog.* 3me édit. ii. 428.

[2] *Med. Obs. and Inq.* 4th edit. i. 358.

[3] *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 144, Lond. 1841.

[4] Beckmann, *Hist. of Inven. and Discov.* iv. 118.

[5] *Dis. Inaug. de Indico*, Berol. 1834; and *Brit. and For. Med. Rev.* ii. 244.

[6] *Pharm. Journal*, xiii. 221.

use of indigo for a few weeks, twitchings of the muscles sometimes were observed, as after the use of strychnia. It has been employed principally in spasmodic affections —viz, epilepsy, convulsions of children, chorea, and hysteria. In epilepsy it has been tried by Von Stahly, Lenhossek, Grossheim, Ideler, Wolf, Lienweber, Dœpp,[1] and Noble,[2] with good effect. Some of the successful cases were of very long standing. Roth says, that at the commencement of the treatment the frequency of the paroxysms was invariably increased. Idiopathic epilepsy is said to have been more benefited by it than the symptomatic epilepsy. I have tried it in a considerable number of epileptic cases at the London Hospital, but without deriving the least benefit from it. The dose of indigo should be as large as the stomach can bear. At the beginning it may be a few grains; afterwards this quantity should be increased to drachms, or even an ounce or more in the day. Some of the patients above referred to, took from ℥ss. to ℥j. daily, for three or more months. The best mode of exhibiting it is in the form of an electuary, composed of one part of indigo and two parts of syrup, with a small portion of water. The powder is apt to cause spasm of the fauces. Aromatics, mild tonics, astringents, and opiates (as the *compound powder of ipecacuanha*), may be conjoined, according to circumstances.

Sub-order II. MIMOSEÆ.

288. ACACIA, *De Candolle.*—VARIOUS SPECIES YIELDING GUM, *E.*

Acaciæ species variæ, *L.*—Acacia varek et A. vera, *D.*
Sex. Syst. Polygamia Monœcia.
(Gummi, *L. D.* – Gum, *E.*)

HISTORY.—The Shittah tree[3], whose wood is mentioned in several parts of the Old Testament[4] is supposed to have been an *Acacia.* By some it has been thought to have been the *A. vera,*[5] by others the *A. horrida.*[6]

Hippocrates speaks of the *Acacia,*[7] which he sometimes calls the *Egyptian Acacia,*[8] at other times the *White Acacia.*[9] He is usually supposed to refer to *Acacia vera;* but Dierbach[10] is of opinion that *A. Senegal* is meant; which, he observes, is distinguished by its white bark, white wood, and white flowers, and therefore the term *white* could apply to it only. Furthermore, the *white fragrant ointment*[11] was probably prepared from the flowers of the *A. Senegal,* and not of *A. vera,* whose flowers would yield a yellow ointment, and not have such an agreeable odour as those of the former species. Hippocrates[12] also mentions *gum* (κόμμι), which he used in medicine. Delile[13] considers the Ἄκανθα διψας

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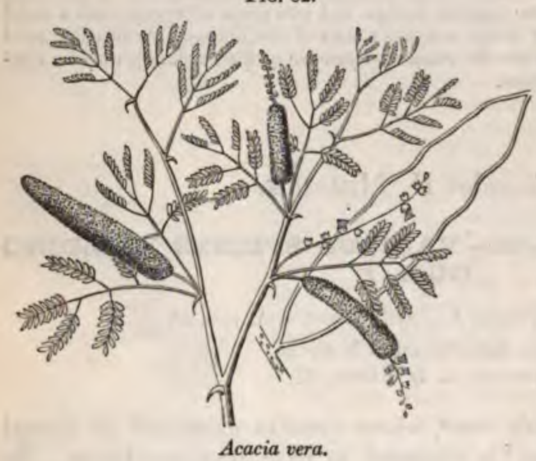
[1] Roth, *op. cit.;* Dierbach, *Neuest. Entd. in d. Mat. Med.* i. 222, 1837.
[2] *Lond. Med. Gaz.* xvii. 1038.
[3] *Isaiah,* xli. 19.
[4] As *Exod.* xxv. 5.
[5] Carpenter, *Script. Nat. Hist.*
[6] *Picture Bible.*
[7] Ἄκανθα or *Thorn,* p. 568, ed. Fœs.
[8] Ἄ. αἰγυπτία, p. 671.
[9] Ἄ. λευκὴ, p. 632.
[10] *Arzneim. d. Hippok.*
[11] Μύρον λευκὸν αἰγυπτιον, p. 265.
[12] Pages 667 and 686.
[13] *Flore d'Egypte,* p. 286, fol.

(*Thirsty Thorn*) of Theophrastus[1] to be *Acacia Seyal*, which Pliny[2] calls *Spina sitiens*.

BOTANY. **Gen. Char.**—*Flowers* polygamous. *Calyx* 4- to 5-toothed. *Setals* 4 to 5, either free or cohering to form a 4- to 5-cleft corolla. *Stamens* varying in number, 10 to 200. *Legume* continuous, juiceless, 2-valved. — *Shrubs* or *trees*. *Thorns* stipular, scattered, or none. *Flowers* yellow, white, or rarely red, capitate or spiked (De Cand.)

Species. 1. A. VERA, Willdenow, L. D.; *Mimosa nilotica*, Linn.; *Egyptian Thorn.*—*Spines* in pairs. *Branches* and *leaves* smooth. *Pinnæ* 2 pairs; *leaflets* 8 to 10 pairs, oblong-linear; with a gland between the pinnæ. *Flowers* in globose heads; heads about two together, stalked, axillary. *Legume* moniliform, (De Cand.) — Middling-sized *tree*. *Flower-heads* bright yellow. — A native of Arabia, and of Africa from Senegal to Egypt. Its fruit, termed *Egyptian and Senegal bablah* (*bablah d'Egypte et du Sénégal*, Guibourt), has been employed in tanning and dyeing. The *succus acaciæ veræ* is the inspissated juice of the unripe fruit, and was formerly used as an astringent. Acacia vera yields *gum Arabic*, and also a portion of the *gum Senegal*.

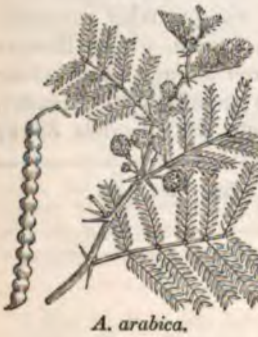
FIG. 62.



Acacia vera.

2. A. ARABICA, Willd. D.; *Acacia nilotica*, Delile; *Mimosa arabica*, Roxburgh. — *Spines* in pairs. *Branches* and *petioles* pubescent. *Pinnæ* 4 to 6 pairs; *leaflets* 10 to 20 pairs, oblong-linear, with a gland beneath the inferior and often between the last pinnæ. *Flowers* in globose, stalked, axillary, subternate heads. *Legume* moniliform (De Cand.)— A small *tree*. *Flower-heads* yellow. — Considered by Ehrenberg to be a variety of the preceding species. — A Native of Senegal, Egypt, Arabia, and India. — Its fruit, termed *Indian bablah* (*bablah de l'Inde*, Guibourt), is used for tanning and dyeing. Probably yields part of the *gum Arabic* and *East Indian gum*.

FIG. 63.



A. arabica.

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[1] *Hist. Plant.* lib. iv. cap. 8.
[2] *Hist. Nat.* lib. xiii. cap. 1, ed. Valp.

3. A. KAROO, Hayne, Nees, and Ebermaier. — Cape of Good Hope. Said to yield *Cape gum.*

4. A. GUMMIFERA, Willdenow.—Arabia; Africa, near Mogadore. Said by Forskäl[1] to yield a gum, which is collected by the Arabs. Probably furnishes, in part at least, *Barbary gum.*

5. A. SEYAL, Delile.—Egypt and Senegambia. Yields a gum which forms part of *gum Senegal.* The tears are white, hard, vitreous, and vermiform.

6. A. TORTILIS, Forskäl, Nees, and Ebermaier.—Arabia. Its gum is collected by the Bedouins of the desert.

7. A. EHRENBERGII, Hayne, Nees, and Ebermaier. — Arabia. Its gum is collected by the Bedouins of the desert.

[According to some authorities the source of Gum Arabic is chiefly from *A. tortilis* and *A. Ehrenbergii,* and not *A. vera.*—ED.]

8. A. SENEGAL, Willdenow; *A. Verek,* Adanson. — Arabia and Africa, from Senegal to the Cape of Good Hope. Abundant in the forest of Sahel, near Senegal. Yields *gum Senegal* in vermiform, ovoidal, or spheroidal tears, which are wrinkled externally, but are transparent internally.

PRODUCTION OF GUM.—The gum of the Acacia trees flows, in the liquid state, from the trunk and branches, and hardens by exposure to the air. It usually exudes spontaneously (see some remarks on the cause of the exudation of gum, *ante,* p. 320). In some instances, however, the discharge is facilitated by incisions. In Barbary the largest quantity of gum is procured during the hot and parching months of July and August. "The more sickly the tree appears, the more gum it yields; and the hotter the weather, the more prolific it is. A wet winter and a cool or mild summer are unfavourable to the production of gum."[2] In Senegal the gum begins to flow when the tree first opens its flowers;[3] and it continues during the rainy season till the month of December, when it is collected for the first time. Another collection of the gum is made in the month of March from incisions in the bark, which the extreme dryness of the air at that time is said to render necessary.[4]

COMMERCE.—Acacia gum is the produce of Africa principally, and of Asia. It is imported from the Levant and other parts of the Mediterranean, from Barbary, Senegal, the East Indies, and the Cape. It comes over in chests, casks, skins, serons, and bags. The duty on it is 6s. per cwt. The following are the quantities on which duty was paid in 1839:[5]—

	Cwts.
Gum from the East Indies	7,869
Senegal gum	24,698
Other sorts of gum	7,759
Total	40,326

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[1] *Fl. Ægypt. Arab.* cxxiv.

[2] Jackson, *Account of the Empire of Morocco,* p. 137, 3d edit.

[3] Adanson, *Mém. de l'Acad. des Sc. de Paris,* p. 8. 1773.

[4] Demanet, *Nouv. Hist. de l'Afrique Françoise,* t. i. p. 56; quoted by Woodville, *Med. Bot.* vol. ii. p. 188.

[5] *Trade List.*

DESCRIPTION.—Acacia gum (*gummi acaciæ*) occurs in variable-sized tears, which are inodorous, more or less coloured, have a slightly sweetish taste, and a greater or less degree of transparency. Ehrenberg asserts that the characters of gum of the same species of plant are liable to considerable variation. Thus the same tree may yield a transparent or an opaque,—a light or a dark coloured, gum. The following are the most important varieties of Acacia gum:—

1. **Turkey or Arabic Gum** (*Gummi turcicum* seu *arabicum; Gummi Mimosæ verum*, Martius; *Gomme arabique vraie*, Guibourt.)—This is imported from Leghorn, Malta, Trieste, Gibraltar, Smyrna, Alexandria, Beyrout, Constantinople, &c. It is the produce of *Acacia vera*, and probably of other species, especially *A. arabica*. It occurs in rounded tears, or amorphous or angular pieces, varying in size from a pea to that of a walnut, or even larger than this; some of the pieces being transparent, others more or less opaque, from innumerable cracks extending through them. It has a glassy lustre, is white, yellow, or wine-yellow, and has no odour, or, if any, an acid one. Its specific gravity varies from 1·316 to 1·482. It may be readily broken into small fragments. It is entirely soluble in water, the solution having the property of reddening litmus, and being feebly opalescent. The latter property is said, by Guerin, to be owing to a small quantity of insoluble nitrogenous matter present. The white pieces constitute the *gummi electum* of our druggists. On the continent they are called *gum Turic* (*gomme Turique*), from *Tor*, the name of a seaport of Arabia, near the isthmus of Suez: while the red pieces are sometimes said to constitute the *gum Gedda* (*gomme Jedda*, or *Gedda*), so called after another port. Gum Gedda is occasionally imported into this country unmixed with other kinds of gum. In all the entries of it which I have been able to trace, it came from Alexandria in barrels.

2. **Barbary or Morocco Gum** (*Gummi Barbaricum*).—This is imported from Mogadore and Mazagan. In 1830, there were imported from Tripoli, Barbary, and Morocco, 2063 cwts. of gum.[1] Barbary gum is probably the produce of *Acacia gummifera*. Jackson says, it is obtained from a high thorny tree, called *Attaleh*. The best kind is procured from the trees of Morocca, Ras-el-wed, in the province of Suse, and Bled-hummer, in the province of Abda:—the second qualities are the produce of Shedma, Duguella, and other provinces. I have two varieties of Barbary gum: one (the *Gomme de Barbarie* of Guibourt) is in roundish or irregular tears, mixed with many impurities, imperfectly transparent, and of a dull yellowish colour, with a faint tint of green.—It is imperfectly soluble in water, and has some analogy to Senegal gum. The other kind (called *Mogadore gum*) is in small, angular, broken, mostly yellow, pieces, which resemble fragments of Turkey gum.

3. **Gum Senegal** (*Gummi Senegalense*).—This gum is imported from St. Louis, St. Mary's, the river Gambia, Senegal, and Bathurst. In 1839, duty (6s. per cwt.) was paid on 24,698 cwt. Gum Senegal is probably obtained from several species of *Acacia;* but especially *A.*

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[1] *Parliamentary Return.*

Senegal, *A. vera*, *A. Seyal*, and *A. Adansonii*, are said to produce it in part. It occurs in larger tears than those of Turkey or Arabic gum. On breaking them we frequently find large air-cavities in their centres. Occasionally we meet with whitish pieces, but for the most part they are yellow, reddish yellow, or brownish red. More difficulty is experienced in breaking or pulverising this gum than gum Arabic, and its fracture is more conchoidal. The taste of this gum is similar to that of the last.

Guibourt distinguishes two varieties of this gum, one of which he terms *Gomme du Bas de Fleuve*, or *gum Senegal, properly so called;* the other the *Gomme du Haut du Fleuve*, or *Gomme de Galam.* The first is probably the produce of *Acacia Senegal*, while the second is procured from *A. vera.* There is but little difference between them: yet gum Galam has a greater resemblance to Turkey gum than Senegal gum has; the pieces are more broken, and therefore more brilliant, than those of gum Senegal, properly so called. Those pieces of gum which have on some part of them a yellowish opaque skin or pellicle constitute the *Gomme pelliculée* of Guibourt. The *Marrons de Gomme*, or *Gomme lignirode* of the same pharmacologist, is also found in the Senegal gum of commerce; it consists of yellowish or dark brownish pieces, which are difficult to break, opaque and rough. Treated with water it is partially dissolved, leaving, says Guibourt, a residue of gnawed wood (*bois rongé*). Guibourt states, that in most of the *marrons* he has found a large ovoid cell, which had been the habitation of the larvæ of some insect; whence he concludes that this substance is the work of an insect.

4. **East India Gum** (*Gummi indicum ostindicum*).—This variety is imported principally from Bombay. In 1839, duty (6s. per cwt.) was paid on 7,869 cwts. It is probably the produce of various species. Many pieces agree in their physical and chemical characters with Turkey and Arabic gum, and are probably the produce of *Acacia arabica*, or some allied species (*Yellow E. I. Gum*). Others, however, are larger, red or brown, and more difficult to pulverise than Turkey or Arabic gum (*brown E. I. gum*). Are these the produce of *Feronia Elephantum?* I have received from Bombay three varieties of gum: one marked *Maculla best gum Arabic*, very similar to gum Galam; a second, marked *Mocha and Barbary gum*, in large, reddish coloured, rough tears; and a third, denominated *Surat inferior gum Arabic*, in smaller dark-coloured tears.

[This description of Acacia, although called *East India gum* because it is imported from Bombay, comes, like gum Olibanum, from the Persian Gulf. It is true that a small quantity of gum is brought from Calcutta, but this is a very inferior description, quite distinct from Bombay gum, and is hardly worth naming as a commercial article in Europe. That East India gum is the produce of Arabia is a view supported by the statement of that experienced botanical traveller Dr. Hooker. In his "Himalayan Journal" he states that, in ascending from Calcutta to the Kymore Hills near Benares, he saw but very little of the *Acacia Arabica* on his way through Behar, and that it is rare eastward of that meridian. It appears to flourish only where the camel flourishes.—ED.]

5. Cape Gum (*Gummi Capense*).—This is imported from the Cape of Good Hope. In 1829 there was exported from the Cape 16,943 lbs. and two cases of gum.[1] In 1830 the quantity imported into the United Kingdom was only 1 cwt. 3 qrs. 14 lbs.;[2] but since then the importation has greatly increased. Mr. Burchell[3] says, Cape gum is obtained from a species of *Acacia* (which he has figured in vol. i. pp. 189 and 325) closely resembling *A. vera,* and which he calls *A. capensis* (*A. Karoo,* Hayne?). It is most abundant on the banks of the Gariep, and between the Cape and the Gariep. Notwithstanding that he asserts the quality of Cape gum is in no way inferior to that of *A. vera,* it is considered by our dealers as a very inferior kind. It is pale yellow; and its appearance resembles Mogadore gum (see p. 334), or small fragments of Turkey gum. It is collected by the Caffres. Gum has also been imported from Australia and South America. A sample of South Australian gum, which the author examined, had more the appearance of Cherry tree gum (cerasin) than of Gum Acacia.

Besides the preceding gums, there are several others described by continental pharmacologists, but which are almost unknown in English commerce. Such are the following:—

α. GUM BASSORA; *Gummi Toridonnense.*—This gum occurs in variable-sized pieces, which are whitish or yellowish, and opaque. When put into water it swells up, but dissolves only in part. The insoluble portion has been called *bassorin.* Its origin is unknown. Virey thinks that it is produced by a *Mesembryanthemum;* Desvaux and Damart, by a *Cactus.*

β. GUM KUTTEERA.—Considered by Guibourt as identical with the preceding; but the sample given me by Professor Royle is very distinct. It has considerable resemblance to the flaky tragacanth (p. 320), for which it has been attempted to be substituted.[4] It is, probably, the produce of *Sterculia urens,* a plant belonging to the family *Byttneriaceæ.*[5]

γ. Under the name of HOG GUM I have met with, in commerce, an unsaleable gum, which greatly resembles a sample sent me by Professor Guibourt, as *gomme pseudo-adraganthe,* or *gomme de Sassa.*[6] It is in reddish yellow, somewhat transparent masses, many of which are twisted like a snail's shell or an ammonite. Some of these are eight or nine inches in diameter. It is yielded by the Maronchea Coccinea, a guttiferous plant.

ADULTERATION.—The inferior and cheaper kinds of gum (as the Barbary, East Indian, and Senegal gums) are not unfrequently substituted for the Turkey or Arabic gum, especially in the form of powder. Flour (or starch) is sometimes mixed with powdered gum; the adulteration is readily recognised by the blue colour produced on the addition of a solution of iodine to the cold mucilage of suspected gum.

COMPOSITION.—Several *ultimate* analyses of gum have been made. The most important are those of Berzelius,[7] Prout,[8] Guerin,[9] and Mulder.[10]

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[1] M'Culloch, *Dict. of Com.*

[2] *Parliamentary Return.*

[3] *Travels in the Interior of South Africa,* 1822-24.

[4] *Nicholson's Journal,* vii. 301.

[5] Roxburgh, *Fl. Indica,* iii. 146.

[6] See his *Hist. des Drog.* ii. 447, 3me édit.

[7] *Ann. de Chim.* xcv. 77.

[8] *Phil. Trans.* for 1827.

[9] *Journ. de Chim. Méd.* vii. 742.

[10] *Pharm. Central-Blatt. für* 1839, S. 137.

	Gum Arabic.			*Gum Senegal.*		*Soluble part of Gum Bassora.*
	Berzelius.	*Prout.*	*Mulder.*	*Guerin.*	*Mulder.*	*Guerin.*
Carbon	41·906	41·4	45·10	43·59	44·92	43·46
Hydrogen	6·788	6·5	6·10	6·23	6·09	6·26
Oxygen	51·306	52·1	48·80	50·07	48·99	50·28
Nitrogen	a trace	0·0	0·0	0·11	0·0	0·0
Total	100·000	100·0	100·00	100·00	100·00	100·00

The formula $C^{13}H^{13}O^{12}$ agrees with the analyses of Berzelius and Prout. Mulder gives, as the formula for gum Arabic, $C^{12}H^{10}O^{10}$. Liebig gives $C^{12}H^{11}O^{11}$. According to the first formula the atomic weight will be =186; according to the second =162; and the third =171.

The *proximate* analysis of gum has been made by Guerin:[1]—

	Gum Arabic.	*Gum Senegal.*	*Gum Bassora.*
Soluble gum (*Arabin*)	79·40	81·10	11·20
Insoluble gum (*Bassorin*)	0·00	0·00	61·31
Water	17·60	16·10	21·89
Ashes	3·00	2·80	5·60
Total	100·00	100·00	100·00

1. SOLUBLE GUM OR ARABIN.—Is a colourless, inodorous, insipid, uncrystallisable solid, soluble in both hot and cold water, but insoluble in alcohol, ether, and oils. It combines with alkalies. Sulphuric acid converts it into a saccharine substance. 100 parts of arabin treated with 400 parts of nitric acid yielded Guerin 16·88 of mucic acid, with a little oxalic acid. From *cerasin* or *prunin*, it is distinguished by its solubility in cold water. The characters by which it is distinguished from *tragacanthin*, *carrageenin*, and *cydonin*, have been already pointed out. According to Guerin, arabin consists of *carbon* 43·81, *hydrogen* 6·20, *oxygen* 49·85, and *nitrogen* 0·14.

2. INSOLUBLE GUM OR BASSORIN.—Is distinguished by its insolubility in water, both hot and cold. It absorbs water, and swells up. It is insoluble in alcohol. 100 parts treated by 1000 of nitric acid furnished 22·61 of mucic acid, with a little oxalic acid. It consists, according to Guerin, of *carbon* 37·28, *hydrogen* 57·87, *oxygen* 6·85.

3. SALTS.—The *ashes* of gums Arabic and Senegal consist of carbonates of potash and lime, with minute portions of chloride of potassium, oxide of iron, aluminum, silica, and magnesia. The carbonate of lime is formed by the decomposition of the malate of lime contained in the gum, while the carbonate of potash results from the decomposition of acetate of potash.

CHEMICAL CHARACTERISTICS.—*Gum Arabic* is soluble both in hot and cold water, forming mucilage. Its fresh solution has an acid reaction, probably from some vegetable, and alcohol added in excess precipitates the gum from it. Diacetate of lead causes a white precipitate (*gummate of lead*) with the solution, but a solution of pure Acacia gum is not precipitated by natural acetate of lead. A solution of silicate of potash (prepared by fusing three parts of carbonate of potash with one part of silver sand) causes a white flaky precipitate. Oxalate of ammonia gives a white precipitate (*oxalate of lime*). When a concentrated solution of neutral sesquichloride of iron is dropped into strong solution of gum, and the mixture stirred, the whole becomes, in a few minutes, a brown semi-transparent jelly. Nitrate of mercury produces a precipitate with a solution of gum.

PHYSIOLOGICAL EFFECTS. *α. On Animals generally.*—The effects of injecting solutions of gum into the veins of animals (horses and dogs) have been examined by Viborg, Scheele, and Hertwich.[1] From their experiments it appears that small quantities only can be thrown into the circulation wiih impunity. From half a drachm to one or two drachms of gum, dissolved in one or two ounces of water, disorder the respiration and circulation of horses; while five or six drachms of gum give rise to an affection of the nervous system, manifested by stupor and paralysis, or convulsions. Some of these effects (namely those on the pulmonary and vascular system) may arise from the non-miscibility of mucilage with the blood, and its consequent mechanical influence in obstructing the capillary circulation of the lungs.

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[1] *Op. supra cit.*

β. *On Man.*—Regnandot[2] injected three drachms of gum, dissolved in three ounces of water, into the veins of a man aged twenty years. In half an hour the patient was very chilly; his pulse was small and quick, and he had three liquid stools. The chilliness was succeeded by great heat, and after fifteen hours an eruption appeared on the skin.

The local action of a solution of gum is that of an emollient, and (by its sheathing properties) demulcent. It is not known to possess any action over remote parts, though some have supposed it to have the power of diminishing irritation in the urinary organs.

Uses.—Gum is employed in medicine as an emollient and demulcent, but more frequently as a vehicle for the exhibition of other medicines. It is sometimes slowly dissolved in the mouth, to allay troublesome cough, and to diminish irritation of the fauces, by diluting the acid secretions, and sheathing the parts from the action of the atmosphere. In inflammatory affections of the intestinal tube, as well as of the respiratory and urinary organs, gum is used as an emollient and demulcent. As a sheathing substance, a solution of gum may be employed in acrid poisoning; but of course its efficacy is mechanical merely. Powdered gum is occasionally applied to check hemorrhage from leech bites. As a vehicle for the exhibition of other medicines, it is employed in the form either of powder or mucilage. The former is used to give bulk to active and heavy powders; as calomel, emetic tartar, &c., and in the preparation of lozenges. The latter is employed to suspend insoluble powders (as oxide of zinc and musk,) in water, or to diffuse oily and resinous substances through aqueous fluids,[3] and to give form and tenacity to pills. Furthermore, the adhesive qualities of mucilage render it exceedingly useful for various other pharmaceutical purposes, although it is now generally superseded by dextrine.

Administration.—The dose of powdered gum is from ʒss. to ʒj., or *ad libitum.*

1. MUCILAGO, E.; *Mucilago Acaciæ*, D.; *Mucilage.*—(Acacia, powdered, ℥ix.; Cold Water, Oj.) The gum to be dissolved without heat, but with occasional stirring, and the solution to be strained through linen or calico.—The *Dublin College* employs ℥iv. of coarsely-powdered

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[1] Wibmer, *Wirk. d. Arzneim. ü. Gift.* Bd. 1. S. 3.

[2] Ibid, *op. supra cit.* S. 6.

[3] See *Experiments on Mixing Oils, Resinous and Pinguious Substances, with Water, by means of a Vegetable Mucilage,* in the *Medic. Observ. and Inq.* vol. i. p. 412, 4th edit. 1776.

Gum to f℥vj. of Water. Dissolve the gum in the water with occasional stirring; then strain through flannel.—By keeping, mucilage, or solution of gum, readily becomes sour by the development of acetic acid. The pharmaceutical uses of mucilage have been above referred to. To render different substances miscible with aqueous vehicles, different proportions of mucilage are required. "*Oils* will require about three-fourths of their weight, *balsams* and *spermaceti* equal parts, *resins* two parts, and *musk* five times its weight."[1]

2. **MISTURA ACACIÆ**, L. E.; *Acacia Mixture.*—The mixture of acacia of the *London College* is similar to the mucilage of the other two Colleges. The formula is as follows:—Acacia, powdered, ʒx.; Distilled Water, boiling, Oj. Rub the acacia with the water, gradually poured in until it is dissolved. Hot water is not necessary for this preparation; and in the author's opinion it has a tendency to acidify the gum, and render the solution somewhat acrid. The *Edinburgh College* gives the following formula for the acacia mixture, which is a compound preparation, and not merely a solution of gum in water.—Mucilage, f℥iij.; Sweet Almonds, ʒx.; Pure Sugar, ʒv.; Water, Oij. Steep the almonds in hot water, and peel them; beat them to a smooth pulp in an earthenware or marble mortar, first with the sugar, and then with the mucilage; add the water gradually, stirring constantly; then strain through linen or calico.—Demulcent and emollient. Applicable to the same purposes as *Mistura Amygdalæ*, already mentioned.—Dose, f℥j. to f℥ij.

3. **TROCHISCI ACACIÆ**, E.; *Gum Lozenges.*—(Gum Arabic, ℥iv.; Starch, ℥j.; Pure sugar, lb.j. Mix and pulverize them, and make them into a proper mass with rose-water for forming lozenges.)—An agreeable pectoral. Employed to allay the tickling in the throat which provokes coughing.

[4. **SYRUPUS ACACIÆ**, U. S.; *Syrup of Gum Arabic.*—Take of Gum Arabic, ℥ij.; Sugar, ℥xv.; Water, ℥viij. Dissolve first the gum in the water without heat, then the sugar with a gentle heat, and strain. This is a convenient pharmaceutical preparation in the form of pills, &c. It is also convenient for the expeditious preparation of cough mixtures.—ED.]

289. ACACIA CATECHU, *Willdenow, L. E. D.*—THE CATECHU ACACIA.

Mimosa Catechu, *Linn.*

Sex. Syst. Polygamia Monœcia.

(*Ligni exterioris extractum, L.*—Extract of the wood, *E.*—Extractum ex ligno, *D.*)

HISTORY.—It is somewhat uncertain who first described Catechu. Gracias ab Orto[2] was of opinion that it was the Λύκιον Ινδικὸν of Dioscorides;[3] but Dr. Royle,[4] in a very elaborate and learned paper on this subject, has apparently proved that the preparation referred to by the latter author is the produce of *Berberis Lycium*, Royle.

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[1] Montgomery, *Observ. on the Dubl. Pharm.*

[2] *Clussi Exot.* lib. i. cap. 10, p. 163.

[3] Lib. i. cap. 132.

[4] *Linn. Trans.* vol. xvii. p. 83.

BOTANY.—**Gen. Char.**—See *Acacia* (p. 333).

Sp. Char.—Arboreous. *Branches* armed with stipulary thorns, or occasionally unarmed. *Young shoots, petioles*, and *peduncles*, more or less pubescent. *Leaves* bipinnated; *pinnæ* 10 to 30 pairs; *leaflets* 30 to 50 pairs; *petiole* sometimes armed on the under side with a row of prickles, with one large gland below the lowest pair of pinnæ, and between the extreme 1 to 6 pairs. *Spikes* axillary, 1 to 4 together, shorter than the leaves. *Flowers* numerous. *Petals* united. *Stamens* distinct, numerous. *Legumes* flat, thin, straight, linear, glabrous, 4- to 8-seeded (Wright and Arnott). *Tree* from 15 to 20 feet high. *Bark* brown and scabrous. *Wood* hard and heavy; the interior (*duramen*) brown, dark red, or blackish; the exterior (*alburnum*) white, one or two inches thick. *Flowers* whitish or pale yellow.

Hab.—Various parts of the East Indies; now common in Jamaica.

MANUFACTURE OF CATECHU.—The manufacture of Catechu from the *Acacia Catechu*, as practised in Canara and Behar, has been described by Mr. Kerr[1] and Dr. F. Buchanan Hamilton,[2] while Dr. Royle[3] has explained the process followed in Northern India. According to the last-mentioned gentleman, "the *Kutt* manufacturers move to different parts of the country in different seasons, erect temporary huts in the jungles, and selecting trees fit for their purpose, cut the inner wood into small chips. These they put into small earthen pots, which are arranged in a double row along a fire-place built of mud (*choola*); water is then poured in until the whole are covered: after a considerable portion has boiled away, the clear liquor is strained into one of the neighbouring pots, and a fresh supply of material is put into the first, and the operation repeated until the extract in the general receiver is of sufficient consistence to be poured into clay moulds, which, in the Kheree Pass and Doon, where I have seen the process, are generally of a quadrangular form. This Catechu is usually of a pale-red colour, and is considered there to be of the best quality. By the manufacturers it is conveyed to Saharunpore and Moradabad, whence it follows the course of commerce down the Ganges, and meets that from Nepal, so that both may be exported from Calcutta."

DESCRIPTION.—The term *Catechu* (from *cate* a tree, and *chu* juice) is applied to various astringent extracts (sixteen of which I have in my collection) imported from India and the neighbouring countries. A few years ago the terms *Catechu, Terra japonica*, and *Cutch*, were employed synonymously; they are now, however, for the most part, used in trade somewhat distinctively, though not uniformly in the same sense. In the *Edinburgh Pharmacopœia* catechu is correctly stated to be the "extract of the wood of *Acacia Catechu*, of the kernels of *Areca Catechu*, and of the leaves of *Uncaria Gambir;* probably, too, from other plants." The following may be taken as a classification of the varieties of catechu commonly met with:—

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[1] *Med. Observ. and Inq.* vol. v. p. 151.

[2] *Journey from Madras through Mysore, Canara, and Malabar*, vol. iii. p. 177, 1807.

[3] *Illustr.* p. 182.

1. *Gambir Catechu; Catechu from Uncaria Gambir.*—The method of preparing Gambir, and the properties of the different commercial varieties of this extract, have been already described (see p. 152). I may further observe, however, that the origin of these varieties of catechu I consider to be satisfactorily made out. They are imported under the name of Gambir from Singapore (where the Uncaria Gambir is cultivated, and an extract prepared from it); they agree with the published descriptions of gambir; and lastly, I find them to be identical with the gambir brought by Mr. Bennett from Singapore, and deposited in the Museum of the Medico-Botanical Society. [In the *London Pharmacopœia* the Gambir catechu is described as an extract of the leaf of Uncaria Gambir.—ED.]

2. *Betel-nut Catechu; Catechu of the Areca Catechu.*—The mode of preparing Betel-nut Catechu, as described by Heyne, has been already stated. Two kinds of astringent extract are said by him to be prepared from these seeds: one called *Kassu*, which is black, and mixed with paddy-husks; and other termed *Coury*, which is yellowish-brown, has an earthy fracture, and is free from the admixture of foreign bodies. I have been able to identify Kassu among the extracts of commerce; but have not satisfactorily made out Coury.

KASSU; *Dark-brown Catechu in circular flat cakes; Colombo* or *Ceylon Catechu* or *Cutch* (*Cachou brun, orbiculaire et plat*, Guibourt). Imported from Ceylon. Cakes round, flat, covered on one side with paddy husks (glumes of rice), from two to three inches in diameter, scarcely one inch thick, and weighing from two to three ounces. Internally they are dark, blackish brown and shiny, exactly resembling Pegu Catechu. Examined by the microscope it is found to contain numerous large crystals. Common. Quality excellent.—A decoction of this catechu becomes turbid on cooling, and frequently produces a blue colour with a solution of iodine, owing to the presence of the rice starch.

That this extract is Kassu, and is obtained from Areca Catechu, is proved by two facts:—

α. It agrees with the Kassu of Heyne in its dark colour, and in being intermixed with paddy husks.

β. It is imported from Ceylon, in which island catechu is obtained from Areca Catechu. For this information I am indebted to a letter (in my possession) addressed to Mr. Lear, acting superintendent of the Botanic Garden in Ceylon, to my late friend Mr. F. Saner, assistant-surgeon in Her Majesty's 61st regiment, then stationed at Colombo. The letter is dated November 17. 1838, and contains the following passage: "Of kino and gambir I am quite unacquainted, and also of the trees which produce them. I should be glad [of] any information on the subject. An extract from Areca Catechu (specimens of which I will procure you) has been supposed to be the Terra Japonica of the shops; but it is generally supposed to be produced from Acacia Catechu, a plant not in Ceylon."

3. *Cutch; Catechu of the Acacia Catechu.*—It is probable that a considerable number of the astringent extracts brought from India as catechu are the produce of the Acacia Catechu. Hitherto, however, a small number only have been positively identified.

α. PALE, DULL CATECHU IN SQUARE CAKES; *Cachou terne et parallélipipède*, Guibourt; *Cachou en manière d'écorce d'arbre*, A. Jussieu. This perhaps is the *Bengal Catechu* of Davy.

It occurs in square cakes, usually about two inches long, two inches broad, and one in thickness. Usually these cakes are irregularly broken, so that it is difficult to trace their angular character. They are heavier than water. Externally their colour is dark brown or blackish; internally we observe darker and lighter layers, disposed in a schistose manner, like the bark of a tree. The darker layers are brown and somewhat shiny, the lighter ones are dull reddish white. Examined by the microscope it is found to consist principally of small crystals. A decoction of one part of this catechu and twelve parts of water lets fall, on cooling, a copious whitish precipitate of *catechine*. I find this kind of catechu to be identical with the specimens brought by Dr. Royle from India, and which he saw prepared from *Acacia Catechu*. Moreover it probably is the kind, the manufacture of which Mr. Kerr described; for he says it is in square pieces, the finest being whitish. So that it is manufactured in Bahar, as well as in the more northern parts of India.

β. DARK SHINY PEGU MASSIVE CATECHU; *Peu Catechu; Cutch; Cachou en masse, Cachou lucide, Cachou du Butea frondosa*, Guibourt. It is imported from Pegu in large masses, weighing sometimes a *cwt.* each. These masses are made up of layers composed of prismatic pieces, each from six to ten inches long, and two or three inches broad and deep. Each piece is enveloped in the leaves of *Nauclea Brunonis*, a native of Tavoy, Wallich. *Cat.* (not of *Butea frondosa*, as formerly supposed). When fractured, these pieces present a dark blackish-brown shiny surface, free from all impurities; some of the pieces, however, having a more reddish tint than the others. Their taste is bitter and astringent. Fée states, though I know not on what authority, that this variety contains 57 per cent of tannic acid. Pegu catechu is largely employed, I am informed, for dyeing. The greater part of that brought to this country is exported for continental use. According to Herbert de Jæger[1] the catechu of Pegu is obtained from the Acacia Catechu; and, he adds, that it is celebrated throughout India.

γ. DARK CATECHU IN BALLS.—I have two varieties of dark-coloured catechu in balls:—

αα. *Enveloped in leaves.*—This agrees in its appearance with the Pegu Catechu above mentioned, and like the latter is enveloped in leaves, apparently of the Nauclea Brunonis. The balls are round and about the size of small oranges (*Pegu Cutch in balls?*).

ββ. *Covered with Paddy Husks.*—Balls more or less flattened, not exceeding the size of a small orange, and covered with paddy husks (glumes of rice). In other respects identical with the preceding. It agrees with the kind referred to by Dr. B. Hamilton, as being procured from Acacia Catechu. When the extract, he says, has acquired the thickness of tar, it is allowed to harden for two days, so that it will not run. "Some husks of rice are then spread on the ground, and the inspissated juice is formed into balls about the size of oranges, which are placed on the husks or on leaves."

4. *Catechu of unknown origin.*—The origin of the larger proportion of the catechus which I have met with, I have not been able to ascertain.

α. BROWN CATECHU IN CONICAL MASSES FROM SIAM.—This variety has recently been imported from Siam in bags. It is in masses shaped like a betel-nut, or rather that of a mullar or truncated olive, each weighing about a pound and a half. The flattened base is marked with the impression of the leaf of *Nauclea Brunonis*. Internally this catechu is shiny and liver-coloured, strongly resembling hepatic aloes. In its other qualities it agrees with Pegu Catechu.

β. CATECHU IN FLAT CAKES.—Under the name of *Cutch* I have received a catechu in flat cakes like the Colombo Catechu, but unmixed with rice glumes. The cakes have a rusty appearance externally.

γ. BLACK MUCILAGINOUS CATECHU; *Cachou noir et mucilagineux*, Guibourt.—In parallelopipeds of eighteen lines on the side, and an inch high. Internally black and shiny, somewhat similar to extract of liquorice. Quality bad.

δ. DARK-BROWN SILICEOUS CATECHU IN FLATTENED, CIRCULAR, OR QUADRANGULAR CAKES; *Cachou brun siliceux*, Guibourt. Formerly called by druggists *Terra Japonica*. Perhaps the *Bombay Catechu* of Sir H. Davy. It is in round or flattened masses, varying in weight from two or three ounces to several pounds; externally it is of a dull dark-brown or rusty-colour, internally being shiny and blackish brown. It is very heavy, and contains a large quantity of fine sand. Guibourt says, 100 parts of this catechu yielded 26 parts of earthy matter. But some of the specimens contain a much smaller proportion of earthy matter. Quality bad.

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[1] *Miscellanea curiosa*, Dec. ii. Ann. iii. p. 9.

ι. **Dull reddish Catechu in balls**; *Cachou en boules, terne et rougeâtre*, Guibourt.—In the collection of the Medico-Botanical Society of London, it is marked *American Catechu*. Balls flattened, weighing three or four ounces, covered on one side with glumes of rice. Its fracture is dull, reddish, wavy, and often marbled. Quality good.

ζ. **Pale or Whitish Catechu in irregular lumps**; *Cachou blanc*, Guibourt.—I received this from Bombay, under the name of *Katha suffaid* (i. e. *pale* or *white catechu*). It is in lumps, which vary in size from that of a walnut to that of a small apple. The general form is rounded or oval, and somewhat flattened, the surface being very uneven, and of a dark or blackish brown colour. Internally this variety is dull, and of a very pale colour. Guibourt says, it is almost white; but it has a pale-yellowish or brownish-red tint. Its taste is bitter, astringent, and sweetish, with a smoky flavour. Hence, perhaps, the dark colour externally is derived from the masses being dried, or exposed to the smoke of a fire.

Composition.—Two kinds of Catechu were analysed by Sir H. Davy.[1] In 1833, Buchner discovered in catechu a peculiar substance which has been denominated *Catechine*.[2]

DAVY'S ANALYSIS.

	Bombay.	*Bengal.*
Tannic acid	54·5	48·5
Peculiar extractive	34·0	36·5
Mucilage	6·5	8·0
Insoluble matter (chiefly and lime)	5·0	7·0
	100·0	100·0

1. **Catechine.**—This has been already noticed (see *Uncaria Gambir*).

2. **Tannic Acid.**—The general properties of this acid have also been before described. It is this substance which renders catechu so valuable to the tanner. The peculiarities of the tannic acid of catechu have been studied by Berzelius,[3] but in consequence of the subsequent discovery of catechuic acid they require re-examination. The tannic acid of catechu is easily soluble in water and alcohol, but very slightly so in ether. The aqueous solution becomes coloured by exposure to the air. Its combinations with acids are very soluble. Alkalies do not precipitate it.

Chemical Characteristics.—The brown, filtered decoction of catechu reddens litmus, yields a blackish-green colour and precipitate (*catechuate* and *tannate of iron*) with the ferruginous salts, and a brownish-white one with acetate of lead. A solution of gelatine renders the cooled decoction turbid (*tannate of gelatine*). Alkalies deepen the colour of the decoction, but cause no precipitate. Sulphuric acid renders the decoction slightly turbid. The filtered decoction of several kinds of catechu (especially *pale catechu in broken square cakes*) deposits, on cooling, catechine. The decoction of *dark-brown catechu, in circular flat cakes*, when cold becomes blue (*iodide of starch*) on the addition of a solution of iodine.

Purity.—The Edinburgh College states that "the finest qualities [of catechu] yield to sulphuric ether 53, and the lowest qualities 28 per cent. of tannic acid dried at 280°." This proceeding, however, is not to be relied on as a test of the astringency of catechu, which can only be determined in the usual way by gelatine. This College errs in supposing that the ethereal extract is necessarily either wholly or in great part tannic acid; for catechuic acid, which constitutes a large portion of some kinds of catechu, is soluble in ether.

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[1] *Phil. Trans.* for 1803, p. 233.

[2] *Pharm. Central-Blatt. für* 1833, 629.

[3] *Traité de Chim.* t. v. 588.

PHYSIOLOGICAL EFFECTS.—Catechu produces the local and general effects of the astringents already described. When of good quality it is more powerful than kino. In its operation it is closely allied to rhatany root (*Krameria triandra*).

USES.—Employed as an astringent in the following cases:—

1. *In affections of the mouth and throat.*—In various affections of the mouth and throat I have frequently employed catechu, and found it a convenient and efficacious astringent. Thus, in relaxed uvula, and in that slight chronic inflammatory affection of the throat usually denominated the relaxed sore throat, and which is especially observed in delicate females, catechu, chewed or sucked, is a most useful remedy. The pure kinds of catechu should be selected, especially avoiding those that are gritty. Catechu in the form of lozenges may be also employed. The pale kinds of catechu (as *gambir*, before described,) are usually sweeter and more agreeable than the dark varieties. To public speakers or singers it is supposed to be useful; it prevents or diminishes hoarseness consequent on a too frequent use of the vocal organs. In slight ulcerations of the mouth also it is useful.

2. *As a stomachic in dyspeptic complaints.*—I have known catechu chewed with advantage in dyspeptic complaints. It should be used just before taking food: it promotes the appetite, and assists digestion.

3. *As an alvine astringent* it may be employed in old-standing diarrhœas and dysenteries, when there are no inflammatory symptoms present. It is often conjoined with the chalk mixture, and not unusually with opiates.

4. *As an astringent in hemorrhages* of an atonic character. A scruple of catechu, with grs. xij. of confection of opium, and a sufficient quantity of aromatic confection to make a bolus, was a favourite prescription of Dr. Babington, sen. in immoderate flow of the menses.[1]

5. *In lead colic* it was recommended by Grashius.[2]

6. *In mucous discharges*, as gleets, fluor albus, or chronic old-standing cystirrhœa.

7. *As a topical application to ulcers.*—"An ointment composed of ℥iv. of catechu, ʒix. of alum, ℥iv. of white resin, and f℥x. of olive oil, with a sufficient quantity of water, is in great repute in India as an application to ulcers."[3]

ADMINISTRATION.—Dose, grs. x. to ʒj. It may be administered in the form of bolus, or of mixture with sugar and gum Arabic. For gradual solution in the mouth, I have found a lump of the purer kinds of commercial catechu more agreeable than *catechu lozenges*.

1. **INFUSUM CATECHU COMPOSITUM**, L. D.; *Infusum Catechu*, E.; *Infusion of Catechu.* Catechu, powdered, ʒvj. [in coarse powder ʒiij. *D.*]; Cinnamon, bruised, ʒj. [ʒss. *D.*]; [Syrup, f℥iij. *E.*]; Boiling [distilled. *L.*],] Water, Oj. [f℥xvij. *E.* ℥ix. *D.*] Macerate the Catechu and Cinnamon in the Water, in a lightly covered vessel, for an hour [half an hour, *D.* Two hours, *E.*], then strain [through linen or calico,

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[1] Ainslie, *Mat. Ind.* i. 590.

[2] *De Colica Pictonum*, Amsterd. 1752.

[3] Thomson, *London Dispens.*

and add the syrup, *E.*]—Astringent. Adapted to diarrhœa. Dose, f℥j. or f℥ij. three or four times a day. Frequently given in conjunction with opiates. Sometimes used in the form of enema.

2. **TINCTURA CATECHU COMPOSITA**, L.; *Tinctura Catechu*, E. D.; *Tincture of Catechu.* (Powdered Catechu, [in coarse powder, *E. D.*], ℥iiiss. [℥iv. *D.*]; Cinnamon, bruised [in fine powder, *E.*], ℥iiss. [℥ij. *D.*]; Proof Spirit, Oij. Macerate for [seven, *L. E.*, fourteen *D.*] days, and strain [and strongly express the residuum; filter the liquors, *E.*]. "This tincture may be also prepared by the process of percolation, the mixed powders being put into the percolator without being previously moistened with the spirit," *E.*)—Astringent. Usually employed as an adjunct to chalk mixture in chronic diarrhœas and dysentery; or occasionally to Port wine, with some aromatic (nutmeg or cinnamon).—Dose, fʒj. to fʒij.

3. **ELECTUARIUM CATECHU**, E.; *Confectio Catechu compositum*, D. (Catechu, ℥iv.; Kino, ℥iv.; Cinnamon, ℥j.; Nutmeg, ℥j. E.; Opium, diffused in a little Sherry, ʒiss.; Syrup of Red Roses, boiled to the consistence of honey, Oiss. Pulverize the solids; mix the Opium and Syrup, then the powders, and beat them thoroughly into a uniform mass).—Astringent. Employed in chronic diarrhœa, dysentery, and hemorrhages. Dose, ℈j. to ℥ij. The *Dublin College* orders the Electuary, now called Confection, to be made by adding five fluidounces of simple syrup to five ounces of compound powder of Catechu. The syrup is gradually added to the powder, and the ingredients are well mixed.

4. **PULVIS CATECHU COMPOSITUS**, D. (Take of Catechu, Kino, of each, ℥ij.; Cinnamon, Nutmeg, of each, ℥ss. Reduce each to powder, mix and pass through a fine sieve. When prepared the powder should be kept in well-stopped bottles.)—The chief use of this compound is for the preparation of the confection above described.

Sub-order III. CESALPINEÆ.

290. HÆMATOXYLON CAMPECHIANUM, *L. E. D.*—THE COMMON LOGWOOD.

Sex. Syst. Decandria Monogynia.
(Lignum, *L. D.*—Wood, *E.*)

HISTORY.—Monardes[1] calls the wood of this plant *lignum ad renum affectiones et urinæ incommoda.* Hernandez[2] terms the wood *lignum nephriticum;* and describes the plant under the name of *coatli.*

BOTANY. **Gen. Char.**—*Sepals* 5, united at the base into a somewhat persistent tube; the lobes deciduous, oblong-obtuse. *Petals* 5, scarcely longer than the sepals. *Stamens* 10; *filaments* hairy at the base;

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[1] *Clusii Exot.* cap. xxvii. p. 324.
[2] *Rev. Med. Novæ Hisp. Thes.* 119.

anthers without glands. *Style* capillary. *Legume* compressed, flat, lanceolate, acuminate at both ends, 1-celled, 2-seeded; the sutures indehiscent; the valves bursting in the middle longitudinally. *Seeds* transversely oblong; *cotyledons* 2-lobed.—*Tree*, with branches unarmed or spinous below the leaves. *Flowers* racemose, hermaphrodite (De Cand.)

Sp. Char.—The only species.

Tree 40 or 50 feet high. *Leaves* pinnate or somewhat bipinnate by the conversion of the lowest pair of leaflets into two pair of pinnæ; *leaflets* obovate or obcordate. *Flowers* yellow.

Hab.—Campeachy. Introduced into Jamaica, where it now grows in great abundance, wild.

COMMERCE.—The stems of the Logwood trees are cut into logs or junks of about three feet long, the bark and white sap (alburnum) of which are chipped off, and the red part or heart (duramen) sent to England.[1] It is imported from Campeachy, Honduras, and Jamaica. In 1839 duty (3s. if from British possessions, 4s. 6d. if from other places) was paid on 15,867 tons.[2] [There is no duty on this article at the present time.—ED.]

DESCRIPTION.—Logwood (*lignum hæmatoxyli* seu *campechianum*), as imported, consists only of the heartwood or duramen. The logs are externally of a dark colour; internally they are red. The wood is dense, has a sp. gr. of 1·057; admits of a fine polish, has a sweetish taste and a pleasant odour. Large crystals of hæmatin are sometimes found in the wood.[3]

[By far the best in quality is that from Campeachy, the best of *this* description being known by the name of "Laguna," the place of shipment. Next to this ranges that from St. Domingo, while the lowest quality, from Honduras and Jamaica, is worth one third less than the Campeachy. Thin, picked, bright pieces are sometimes sold separately, under the name of "Oporto Wood," such being exported to Oporto for the colouring of wine.—ED.]

COMPOSITION.—Logwood was analysed in 1811 by Chevreul,[4] who found its constituents to be *volatile oil*, *hæmatin*, *fatty* or *resinous matter*, *brown substance containing tannin*, *glutinous matter*, *acetic acid*, *woody fibre*, *various salts* (phosphate, sulphate, and acetate of lime, acetate of potash, and chloride of potassium) and the *oxides* of aluminum, silicon, manganese, and iron.

HÆMATIN or *Hæmatoxylin* is a red crystalline substance, of a slightly bitter, acrid, and astringent taste. It is soluble in alcohol and ether, and slightly so in water. Acids render the solution yellowish or red; alkalies give it a purple or violet colour. Alum causes a violet precipitate, and several metallic solutions (as of tin and lead) a blue one. Gelatine produces a flocculent reddish precipitate.

CHEMICAL CHARACTERISTICS.—The decoction of logwood is deep red. Acids render it paler and brighter coloured. The alkalies give it a purplish or violet-blue colour. Acetate of lead causes a blue, alum violet, precipitate. The salts of iron make it a dark violet-blue. latine forms a reddish precipitate with it.

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[1] Wright, *Med. Plants of Jamaica.*

[2] *Trade List.*

[3] Thomson, *Org. Chem.* 407.

[4] *Ann. de Chim.* lxxxi. 128.

PHYSIOLOGICAL EFFECTS.—Logwood is a mild astringent (see the ects of Astringents). It does not constipate nor so readily disorder digestive organs as some other astringents, and hence its use may be ntinued for a longer period. Its colouring matter becomes absorbed, d may be detected in the urine. Dr. Percival[1] states, that under the of extract of logwood the urine of a female suddenly acquired a rplish-red colour, which was deepened by the sulphate of iron. After ne hours the secretion returned to its natural colour. The stools netimes acquire a purplish red colour from the use of logwood.

[Dr. J. M. Barry, of Totness, Devon, has communicated to the thor the particulars of a case, which shows that the use of logwood chronic diarrhœa may be attended with the unpleasant effect of lucing phlebitis. In this case the diarrhœa was of several years' nding: it had resisted all the usual remedies, but yielded to the hibition of a few doses of logwood. The arrest of the diarrhœa was nost immediately followed by *phlebitis*, affecting in a very marked nner the veins of one of the lower extremities. It was removed active antiphlogistic treatment. The diarrhœa recurred, and the wood was again prescribed, and the same effects ensued: the rrhœa was checked, and the venous inflammation reappeared. In . Copland's *Dictionary*, under the head of "Neuralgic Affections," 885, another case is mentioned in the following terms:—"A gentlen from the country very recently came under my care for chronic rrhœa of seven years' continuance. He had experienced two attacks phlebitis of the femoral veins, consequent upon having taken the tract of logwood, this medicine having restrained but not arrested the rrhœa." These facts will show that some caution must be used in medicinal employment of logwood.—ED.]

USES.—In medicine, logwood is employed as an astringent in old rrhœas and dysenteries, in hemorrhages (from the uterus, lungs, and wels), and leucorrhœa. It is well adapted to the diarrhœas of ildren. Dr. Percival employed it to restrain profuse sweating in thisis.

1. **DECOCTUM HÆMATOXYLI**, L. E. D.; *Decoction of Logwood.* (Logod in chips, ʒx. [℥j. *D. E.*]; Water, Oiss. [Oj. *E.*; Oss. *D.*]; nnamon in powder, ʒj. *E.* Boil down to a pint and strain, *L.* Boil logwood in the water down to ten fluidounces, adding the cinnamon wards the end, and strain, *E.* Boil for ten minutes in a covered ssel, and strain. The product should measure about eight ounces, *D.*) Employed as an astringent in diarrhœa.—Dose, for adults, f℥j. to ij.; for children, fʒij. to f℥ss.

2. **EXTRACTUM HÆMATOXYLI**, L. E.; *Extract of Logwood.* (Cut Logod [in chips, *E.*] lbs. iiss. [lb. j. *E.*]; Boiling [distilled, *L.*] Water, *ng.* ij. [*a gallon*, E.] Macerate for twenty-four hours, then boil wn to a gallon [Oiv. *E.*], and strain the liquor while hot; lastly,

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[1] *Works*, vol. iv. p. 386.

evaporate, in the vapour bath, to a proper consistence, *E.*)—The *London College* directs that the extract should be prepared in the same manner in which it has been ordered concerning extract of liquorice. "For preparing this extract the logwood should not be powdered, but rasped, and it should be so far evaporated as to become brittle and pulverulent when cold. One *cwt.* of the wood yields about twenty lbs. of extract."[1]—Astringent. Employed in old diarrhœas and dysenteries. Dose, grs. x. to ʒss. By keeping, extract of logwood becomes exceedingly hard, and pills made of it are said to have passed through the bowels undissolved. It is employed, I am informed, to colour snuff.

291. TAMARINDUS INDICA, *Linn. L. E. D.*—THE COMMON TAMARIND TREE.

Sex. Syst. Monadelphia Triandria.
(Fructûs pulpa, *L. D.*—Pulp of the pods, *E.*)

HISTORY.—The tamarind does not appear to have been known to the ancient Greeks; at least no mention is made of it in their writings. We are indebted for its introduction to the Arabians, who probably derived their knowledge of it from the Hindus. Mesue, Avicenna, and Serapion, are the earliest writers who mention it. It is said to have derived its name from *Tamar* (which, in Arabic, signifies *dates*), and *Indus*, in reference to its Indian origin.

BOTANY. **Gen. Char.**—*Calyx* tubular at the base; limb bilabiate, reflexed; upper lip 3-partite; lower broad, 2-toothed. *Petals* 3, alternating with the segments of the upper lip of the calyx; two of them ovate, the middle one cucullate. *Stamens* 9 or 10; seven very short and sterile, the others (two or three) longer, monadelphous, bearing anthers. *Style* subulate. *Legume* stalked, linear, more or less curved, slightly compressed, 1-celled, 3- to 12-seeded, the sarcocarp pulpy. *Seeds* compressed, bluntly 4-angled, obliquely truncated at the hilum.—*Trees. Leaves* abruptly pinnated; *leaflets* many pair. *Flowers* racemose (Wright and Arnott).

Sp. Char.—The only species. *Tree*, 30 to 40 feet high. *Branches* spreading. *Leaves* alternate; *leaflets* 12 to 15 pair, small, oblong, obtuse, entire, smooth. *Petals* deciduous, yellow, veined with red.

There are two varieties, which are considered by Gaertner, Roxburgh, and De Candolle, as distinct species. The only difference between them is in the pod.

α. Orientalis; T. indica, De Candolle; *East Indian Tamarind.*—*Legume* elongated, six or more times longer than broad, 6- to 12-seeded.

β. Occidentalis; T. occidentalis, De Candolle; *West Indian Tamarind.*—*Legume* abbreviated, scarcely three times longer than broad, 1- to 4-seeded.

Hab.—East and West Indies.

PRESERVATION OF THE FRUIT.—The usual mode of preserving tamarinds in the West Indies is, to remove the shell or epicarp from the ripe fruit, and to place layers of the shelled fruit in a cask, and pour boiling water over them. But Dr. Wright[2] says, a better method is, to put alternate layers of tamarinds and powdered sugar in a stone jar. The drier and dark-coloured East Indian tamarinds are said to be preserved without sugar.

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[1] Brande, *Man. of Pharm.*

[2] *Med. Plants of Jamaica.*

Commerce.—There are two descriptions: *a.* The black, from Batavia and Calcutta, in casks of about 2 cwt., in the form of a dark-brown or black paste, consisting of the pulp and seeds, and some fibres. It does not contain any sugar; and the blacker in colour and the more free from seed and fibre, the more it is esteemed. It is very extensively used in medicine on the Continent, where the West Indian is hardly known, except here and there as a comfiture.

[*b.* The West Indian, imported from most of the West Indian islands, in barrels. This description is always preserved in sugar, and consists mostly of entire pods. The more perfect these are, and the more golden their colour, the higher their value, which is from two to fourfold that of the East Indian description.—Ed.]

Description. — Tamarinds are imported both raw and preserved. *Tamarind pods* are from three to six inches long, more or less curved. Composed of a dry, brittle, brown, external shell (*epicarp*), within which is the acidulous, sweet, reddish-brown pulp (*sarcocarp*), penetrated by strong fibres. Still more internal is a thin membranous coat (*endocarp*) inclosing the oval brown seeds. *Preserved tamarinds* (*tamarindi conditi*) consist of the same parts, the shell (*epicarp*) excepted. The *pulp* (*pulpa tamarindi*) is the officinal part.

Composition.—Tamarind pulp was analysed, in 1790, by Vauquelin,[1] who obtained the following products: — *Citric acid* 9·40, *tartaric acid* 1·55, *malic acid* 0·45, *bitartrate of potash* 3·25, *sugar* 12·5, *gum* 4·7, *vegetable jelly* (pectin) 6·25, *parenchyma* 34·35, and *water* 27·55.

Physiological Effects. —Tamarind pulp allays thirst, is nutritive and refrigerant, and, in small doses, laxative. From this combination of refrigerant and laxative properties it is commonly denominated a *cooling laxative.*

Uses. — Tamarinds are adapted for febrile and inflammatory cases; in the former it is often taken with the double purpose of operating as a refrigerant and acting gently on the bowels. An infusion of tamarinds forms a very pleasant, cooling drink, as does also tamarind whey. Tamarinds are a constituent of several mild purgative preparations. They are frequently given in conjunction with senna (as in the *confection of senna,* Ph. D.) It is said, though I know not with what truth, that the addition of tamarinds to senna and resinous cathartics diminishes the operation of the latter.

Administration. — The dose of tamarinds is from ʒij. to ℥j. or more. *Tamarind whey* (*serum lactis tamarindatum*) is prepared by boiling ℥ij. of tamarind pulp with Oij. of milk.

TAMARINDUS PRÆPARATUS, L. (Tamarind, lb. j.; Water, as much as may be necessary to cover the tamarind. Macerate by a gentle heat for four hours, and express the pulp first through a coarse then through a fine sieve; lastly, evaporate to the consistence of a confection.)

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[1] *Ann. de Chim.* v. 92.

292. CASSIA OFFICINALIS, *Linn. L.* (*Senna officinalis*, Roxb.—SENNA.

Cassia lanceolata; C. obovata, *De Cand.*—Cassia auctifolia; C. elongata, *D. E.*
Sex. Syst. Decandria Monogynia.
(Folium, *L.*—Leaves, *D. E.*)

HISTORY. — The early history of this purgative is somewhat obscure, but it was probably in use some centuries before any mention of it is made in the works of pharmacological writers. Among the Arabians I may quote Mesue, Serapion, and Avicenna, who notice senna (sene), but they refer to the fruit, and not to the leaves. Mesue, in speaking of the decoction of senna, quotes Galen; and from this, as well as from other circumstances, it has been imagined that Dioscorides and Galen, and probably even Theophrastus, were acquainted with senna; but their known writings do not warrant this opinion, and hence the quotation is presumed to be erroneous. The earliest Greek writer in whose works senna is mentioned, is Actuarius; but he, like the Arabians, referred to the fruit.

BOTANY. **Gen. Char.** — *Sepals* 5, scarcely united at the base, more or less unequal. *Petals* 5, unequal. *Stamens* 10, free, unequal; the three lower ones longer, the four middle ones short and straight, the three upper ones with abortive anthers. *Anthers* dehiscing at the apex. *Ovary* stalked, frequently arched. *Legume* various. — *Trees, shrubs,* or *herbs. Leaves* simply and abruptly pinnate. *Petioles* frequently glanduliferous. *Leaflets* opposite.

Species. — Some confusion still exists as to the species yielding the senna leaves of commerce. Linnæus made but one species, which he termed *Cassia Senna*, and considered the acute and obtuse-leaved plants as mere varieties. The usually-accurate Woodville[1] has published a plate representing the leaflets of the acute-leaved Cassia, and the fruit of the blunt-leaved species. The following perhaps are distinct species, but their specific characters are not in all cases accurately ascertained. The *London College* has adopted the specific name officinalis in conjunction with obovata, and distinguishes the Alexandrian from the Indian senna, by the acute ovate or mucronate obovate leaves of the former, and the lanceolate leaves of the latter.

1. C. OBOVATA, *Colladon*;[2] C. Senna var. *β.*, *Linn.*; C. obtusa, *Roxb.*;[3] Sena belledy (Wild Senna), *Egyptians* and *Nubians*; Séné de la Thébaïde, Cassia Sena, *Nectoux.*[4] — *Leaflets* 6 to 7 pairs, obovate, obtuse; petiole glandless. *Legumes* plano-compressed, curved, tumid by the crests on the middle of each valve (De Cand.)—Perennial *herb*, 1 or 2 feet high. *Leaves* smooth; *leaflets* mucronate, unequal at the base. *Stipules* lanceolate, linear, spreading. *Flowers* yellow in racemes. *Legumes* oblong, falcate, smooth, rounded at each end, with an equally

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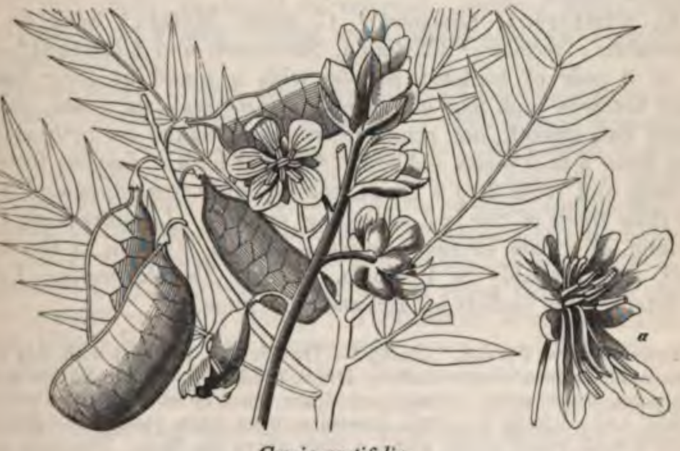
[1] *Med. Bot.* iii. 446.
[2] *Hist. des Casses*, 92.
[3] *Fl. Ind.* ii. 344.
[4] Pl. i.

interrupted ridge along the middle of each valve. — Egypt (Bassà-Tine at the entrance of the valley of Egaremont, two leagues from Cairo; Karnak; Thebes; on the eastern bank of the Nile opposite Hermonthis; Esneh; Edfou; Daraou; Assouan); Nubia; Desert of Suez; Syria; India. Cultivated in Italy, Spain, Jamaica, &c. — Its leaflets form *Aleppo*, *Senegal*, and *Italic Senna*, and one of the constituents of *Alexandrian Senna.*

Nees and Ebermaier[1] follow Hayne in admitting two species of blunt senna, viz. *C. obovata*, Hayne, with obovate, very shortly pointed leaflets, and *C. obtusata*, Hayne, with more remote, obovate, truncated-emarginate leaflets. I think, with Th. Martius,[2] that the latter are merely older leaflets than the former.

2. C. ACUTIFOLIA, D.; *Delile.*[3] — *Stem* suffruticose. *Leaves* pinnate; *petiole* glandless; *leaflets* 5 to 7 pairs, lanceolate, acute. *Legumes* flat, elliptical, naked on both sides, somewhat bent on the upper margin (Delile). — An *undershrub*, about two feet high. *Leaves* when young slightly silky or pubescent. *Flowers* yellow, in axillary racemes, at the top of the branches. *Petals* obovate. *Legumes* somewhat swollen by the seeds. *Seeds* 6 or 7 in each legume. — Egypt, in the valleys of the desert to the south and east of Assouan. — Collected by the Arabs, and sold by them to merchants who convey it to Cairo.

FIG. 64.



Cassia acutifolia.
a. An expanded flower.

3. C. ELONGATA, *D.*, *Lemuire-Lisancourt;*[4] *Fée;*[5] C. lanceolata, *Royle.*[6] Perhaps identical with the preceding species. Dr. Royle's specimens were raised from seeds picked out of *Mecca Senna.* Dr. Lindley thus describes the plant. "An *annual*, but, with care, it may be made to

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[1] *Handb. d. med.-pharm. Bot.* ii. 207.
[2] *Pharmakogn.*
[3] *Fl. Ægypt.* Pl. 27, fig. 1.
[4] *Journ. de Pharm.* vii. 345.
[5] *Journ. de Chim. Méd.* vi. 234.
[6] *Illustr.* t. 37.

live through the year, and to assume a suffruticose habit. *Stem* erect, smooth. *Leaves* narrow, equal pinnated; *leaflets* 4 to 8 pairs, lanceolate, nearly sessile, slightly mucronulate, smooth above, rather downy beneath, with the veins turning inwards, and forming a flexuose intramarginal line; *petioles* without glands; *stipules* softly spinescent, semihastate, spreading, minute. *Racemes* axillary and terminal, erect, stalked, rather longer than the leaves; *pedicels* without bracts. *Sepals* linear, obtuse. *Petals* bright yellow. Of the *stamens* the five lowest sterile and small, the two next large, curved, and perfect, the three uppermost minute and gland-like. *Ovary* linear, downy, falcate, with a smooth recurved *style*. *Legumes* pendulous, oblong, membranous, about an inch and half long, and five-eighths broad, quite straight, tapering abruptly to the base, and rounded at the apex, deep-brown, many-seeded."—Grows in India, but probably only naturalised.—Yields *Tinnevelly* and *Mecca Senna*.

4. C. ÆTHIOPICA, *Guibourt;*[1] *C. ovata*, Mérat;[2] Séné de Nubie, C. lanceolata, *Nectoux;*[3] C. Senna, Stevenson and Churchill.[4]—*Leaves* of 3 to 5 pair of leaflets; *petioles* with a gland at their base, and another between each pair of leaflets; *leaflets* oval-lanceolate, pubescent. *Legumes* flat, smooth, not reniform, rounded, naked on both sides, containing from 3 to 5 seeds.—About 18 inches high. *Leaflets* from 7 to 9 lines long, and from 3 to 4 broad, consequently less elongated and less acute than those of the two preceding species. *Legumes* from 11 to 15 lines long, of a pale or fawn colour.—Nubia, Fezzan, to the south of Tripoli, and probably to Ethiopia. Yields *Tripoli Senna*. I think I have detected the leaflets in *Alexandrian Senna*.

5. C. LANCEOLATA, *Forskäl,*[5] *Lindley.*[6]—Dr. Lindley, who met with this species in a collection of Arabian plants made by Dr. S. Fischer, says, "the *leaflets* are in four or five pairs, never more; oblong, and either acute or obtuse, not at all ovate or lanceolate, and perfectly free from downiness even when young; the petioles have *constantly* a small round brown gland, a little above the base. The *pods* are erect, oblong, tapering to the base, obtuse, rigid, mucronate, rather falcate, especially when young, at which time they are sparingly covered with coarse scattered hairs."—This species is therefore distinct from both *C. acutifolia*, Delile, and *C. elongata*, *Lemaire*. Forskäl says it grows about Surdud, Mor, and Abuarish; and that it is the *true Mecca Senna*.

6. C. MARILANDICA, Linn.—*Leaflets* 8 to 9 pairs, ovate-oblong, mucronate, equal, with an ovate gland at the base of the petiole. *Racemes* axillary, many-flowered, shorter than the leaves. *Legumes* compressed, linear, hispid, subsequently smoothish (De Cand.)—From three to six feet high. *Flowers* golden yellow.—United States; common in all parts south of New York.—Yields the *American Senna*.

COMMERCE.—Senna is imported from the Mediterranean (either directly from Egypt, or at second hand from Italy), and from the East Indies (Madras and Bombay), usually in bales. The quantities on which duty was paid during two years was as follows:—

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[1] *Hist. des Drog.* 3d edit. ii. 319.
[2] *Dict. de Mat. Méd.* vi. 311.
[3] *Voy. dans la Haute Egypte*, t. ii.
[4] *Med. Bot.* i. fig. 30.
[5] *Fl. Ægypt. Arab.* 85.
[6] *Fl. Med.* 259.

	In 1838.		*In* 1839.
From the East Indies	72,576 lbs.		110,409 lbs.
From other places	69,538 „		63,766 „
Total imported	142,114 „		174,175 „

[The following were the quantities of senna on which duty was paid during a period of five years: —

1840	86,580 lbs.	1843	200,058 lbs.
1841	90,930 „	1844	114,323 „
1842	160,502 „		

There is at present no duty on senna.—ED.]

DESCRIPTION. — Senna (*folia sennæ*) has a peculiar, agreeable, tea-like odour, and a nauseous, bitter taste. Its colour should be bright and fresh. If largely mixed with extraneous matter, if it be much broken or very dusty, it should be rejected. Boiling water extracts about a third of its weight. Proof spirit yields a brown — alcohol or ether a green tincture.

1. Alexandrian Senna; *Senna Alexandrina; Folia Sennæ Alexandrinæ.*— Called by the French *Séné de la Palthe* (i. e. *Tribute Senna*) because it is obliged to be sold to the Egyptian government, who resell it to Europeans. It is imported in bales from Alexandria and other Mediterranean ports. It consists of the leaflets of two or more species of *Cassia* (*C. acutifolia, C. obovata,* and sometimes *C. æthiopica*) mixed sometimes with the leaves of *Cynanchum Argel,* and sometimes with those of *Tephrosia Apollinea.* The flowers and fruits of these plants are usually present in greater or less quantity. Alexandrian senna is collected in Nubia and Upper Egypt, and is conveyed down the Nile to the great depôt at Boulak. [According to Mr. Redwood, the adulteration of senna with the leaves of the *Cynanchum Argel* is now the exception to the rule. In examining some bales of Alexandrian senna, he found the leaves genuine; in others there was a slight admixture.—ED.]

For the following particulars I am indebted to the writings of Delile,[1] Rouillure,[2] Nectoux,[3] and Burckhardt.[4] Senna is collected by the Arabs of the tribe of Abaddeh. They make two crops annually,—the most productive one is that after the rain in August and September; the second takes place about the middle of March. When cut the plants are spread out on the rocks, and dried in the sun (Nectoux).

Assouan is the first entrepôt for senna. It receives all that is gathered in the neighbourhood. Esneh is another entrepôt. It receives the acute-leaved senna from Abyssinia, Nubia, and Sennaar, from whence it arrives by the caravans which convey negroes to Egypt, and blunt-leaved senna, gathered in Upper Egypt (Rouillure). Daraou, between Assouan and Esneh, is also an entrepôt; but the great depôt is at Boulak, the port of Cairo. Here the monopoly of senna was farmed out by Mahommed Ali to Rosetti, an Italian, for about £3,500 per annum (Burckhardt). The senna arrives at Boulak from Assouan, not only by the Nile, but also by the way of Cosseir, the Red Sea, and Suez. As, however, the latter is a more expensive route, it is not so frequently followed (Nectoux). Lastly, some senna is carried to Boulak by the caravans from Mount Sinai. The following are said by Roulliure to be the quantities brought from these places:—

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[1] *Mém. sur l'Egypte,* iii. 315, 1799; and *Fl. Ægypt.*

[2] *Ann. de Chim.* lvi. 161.

[3] *Phil. Mag.* xv. 55; and *Voyage dans la Haute Egypte,* 1808.

[4] *Travels in Nubia,* 2d edit. pp. 22 and 49.

	QUINTALS.			
	Acute-leaved Senna.	*Obovate ditto.*	*Ethiopic ditto.*	*Argel leaves.*
From Assouan	7000 to 8000	500 to 600	...	2000 to 2400
From Esneh	...	800	2000	...
From Suez and Mount Sinai	...	1200 to 1500	...	...
Total of each kind	7000 to 8000	2500 to 2900	2000	2000 to 2400

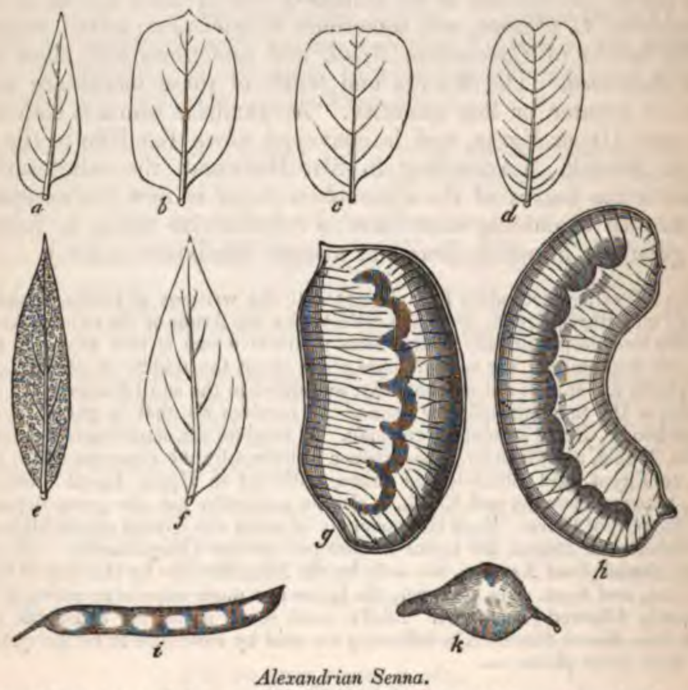
So that the total amount of all kinds is, according to this statement, 13,500 to 15,300 quintals.

The mixture of the different leaves takes place at the entrepôts. Nectoux mentions those of Kénéh, Esneh, Daraou, Assouan, where it is effected. Rouillure says that at Boulak, 500 parts of acute-leaves are mixed with 300 of obtuse leaves, and 200 of Argel leaves.

From Boulak the senna is sent to Alexandria, and from thence is shipped to Europe.

Alexandrian senna has a greyish-green colour, an odour which somewhat resembles that of tea, and a viscid taste. It presents a broken appearance, and on examination is found to consist of the leaves, flowers, and fruits of the above-mentioned plants mixed with various extraneous matters (as seeds, date-stones, rabbit-dung, stones, &c.). The latter are in great part separated by hand-picking, sifting, &c., before the senna is fitted for use. It then constitutes *picked Alexandrian senna* (*folia sennæ Alexandrinæ electæ*).

FIG. 65.



Alexandrian Senna.

a Leaf of Cassia acutifolia.
g Pod of ditto.
b Leaf of C. obtusata.
c Leaf of C. obovata.
h Pod of ditto.

e Leaf of Cynanchium olæfolium.
k Pod of ditto.
d Leaf of Tephrosia apollinea.
i Pod of ditto.
f Leaf of Coriaria myrtifolia.

α. CASSIA LEAFLETS, FLOWERS, and LEGUMES. — The *leaflets* of cassia are readily distinguished from those of other genera found in senna, by being unequal-sided; that is, by two sides of the leaflet being unequal in size, shape, or length, and by the veins or nerves of their under surface being very conspicuous. The acute-leaved are very readily distinguished from the blunt-leaved species, by their shape. The dried *flowers* of Cassia may be easily detected; they are dull yellow. I have not been able to make out their species. The *legumes* of the obovate and acute-leaved Cassia are also found; they are distinguished by the botanical characters before described.

β. ARGEL LEAVES, FLOWERS, and FRUIT (*Cynanchum*). — The Argel plants are collected by the Arabs, in the valleys of the Desert to the east and south of Assouan (Delile). The *leaves* found in Alexandrian senna are distinguished from the senna leaflets by their being equal-sided, — by the absence or imperfect development of their lateral nerves, — by their paler colour, thicker and more coriaceous texture, — by a yellowish exudation frequently found on them, — and generally, though not invariably, by their greater length. Under the name of *heavy senna* I have met with argel leaves, which were sold at a higher price than ordinary senna. These leaves were left in the fanning process, by which the real senna leaves were separated. By careful picking the *flowers* may be detected; they are white, and in small corymbs. In some recently imported bales, argel flowers constituted nearly a fourth part. The *fruit*, as found in Alexandrian senna, seldom exceeds in size that of a good-sized orange-pip. It is an ovoid follicle, tapering superiorly, brown, shrivelled, and contains several seeds.

γ. TEPHROSIA LEAFLETS and LEGUMES. — The *Tephrosia Apollinea* (*Galega Apollinea*, Delile, pl. 53) grows in cultivated fields near the Nile, at Hermonthis, at Edfou, and in the Elephantine Islands, opposite Assouan. The *leaflets* have a silky or silvery aspect; they are obovate-oblong, somewhat cuneiform, emarginate, equal-sided, tapering towards the base; lateral veins parallel, regular, and oblique to the midrib. These leaflets are usually found loaded longitudinally, and are very apt to be overlooked. The *legume* is from an inch to an inch and a half long, not exceeding two lines broad, linear, slightly ensiform, and contains six or seven brownish seeds.

2. Tripoli Senna; *Senna Tripolitana; Folia Sennæ Tripolitanæ.* — It is carried to Tripoli in caravans, which go from Fezzan. In general appearance it resembles Alexandrian senna; but the leaflets are more broken, smaller, less acute than the acute-leaved Alexandrian senna, thinner, greener, and of a less herbaceous odour. They are the produce of *C. Æthiopica*, usually unmixed with any other species. But I have a sample which contains also the leaflets of *C. obovata* and argel leaves.

Tunis senna agrees with that of Tripoli.

3. Aleppo Senna. — Consists of the leaflets of *C. obovata*.

4. Senegal Senna; *Senna Senegalensis.* — Is a blunt-leaved senna, having a rougher and more glaucous appearance than the leaflets of *C. obovata*. Some years since a small bale of it was sent by the French *Ministre de la Marine* to M. Henry for examination.[1] I am indebted to the kindness of Professor Guibourt for a sample of it.

5. Smyrna Senna. — Very similar to Tripoli senna, but some of the leaflets resemble the acute-leaved Alexandrian senna.

6. Mecca Senna; *Senna Meccensis; Inferior* or *Second East Indian Senna; Séné Mohu*, Guibourt; *Séné de la Pique*, or *Pike Senna; Suna Mukkee*, Royle. — Imported into England from India. It is the produce of Arabia, and finds its way into the interior of India by the ports of Surat and Bombay. Dr. Royle was informed that it was grown somewhere in the Agra and Muttra district, but was never able to prove the fact.[2] It occurs in long narrow leaflets, of from an inch to an inch and a half long, narrower than those of Tinnevelly senna, and of a yellowish colour; some of the leaflets being brownish, or even blackish. This change of colour is probably the result of the action of a moist atmosphere. Legumes are occasionally intermixed; they are from 1½ to 3 inches long, and from 7 to 8 lines broad; slightly curved, greenish in their circumference, blackish in their centre, with a smooth surface. Recently this senna in good condition has been imported from Turkey in casks. It appears to be fresh and fine, and approximates to Tinnevelly senna in colour; but contains stalks and dust, with a few stones.

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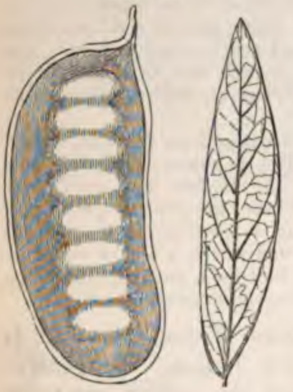
[1] *Journ. de Pharm.* xiv. 70.

[2] *Illustr.* 187.

7. Tinnevelly Senna; *Finest East Indian Senna; Séné de l'Inde*, Guibourt.—Cultivated at Tinnevelly, in the southern part of India, by Mr. G. Hughes. It is a very fine unmixed senna, which is extensively employed, and fetches a good price. It consists of large, thin unbroken leaflets, of a fine green colour, from 1 to 2 inches, or more, long, and sometimes half an inch broad at their widest part. When exposed to a damp atmosphere, they are apt to change colour, and to become yellow or even blackish.

FIG. 66.



a. Legume of Tinnevelly Senna (*C. elongata*).
b. Leaflet of ditto (*Royle*).

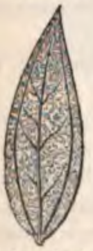
8. American Senna; *Senna Americana*.—Is the produce of *Cassia Marilandica*, but never reaches this country as an article of commerce. That which I have received was prepared by the Shakers of the United States, and has been compressed into an oblong cake. The leaflets are oblong, lanceolate, from 1½ to 2 inches long, and from ¼ to ½ an inch broad, thin, pliable, and of a pale green colour. They have a feeble odour and a nauseous taste, like the other sennas.

ADULTERATION.—Senna is not, to the best of my belief, adulterated in this country. The leaflets of *Colutea arborescens* or *Bladder Senna* have, on the continent, been occasionally intermixed. They are elliptical, regular, and obtuse. Their regularity at the base would at once distinguish them from the leaflets of *Cassia obovata*.

Argel leaves, mixed with a few leaflets of *C. acutifolia*, I have known to be recently sold as *picked* or *heavy senna* at a higher price. It was done rather from ignorance than fraud.

A serious adulteration has been sometimes practised on the continent, by the substitution of the leaves of *Coriaria myrtifolia* for those of senna.[1] They are ovate-lanceolate, greyish-green with a bluish tinge, 3-nerved, with a strongly-marked midrib; the two lateral nerves

FIG. 67.



Leaf of Coriaria myrtifolia.

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[1] *Journ. de Chim. Méd.* i. 284.

disappear towards the summit of the leaves. Chemically, these leaves are distinguished by their infusion yielding, with gelatine, a whitish precipitate (*tannate of gelatine*); and, with sulphate of iron, a very abundant blue precipitate (*tannate of iron*). Furthermore, it forms precipitates with bichloride of mercury, emetic tartar, and chloride of barium. [The true Senna leaf is unsymmetrical on the two sides, while in the leaf of Coriaria the two sides are equal and symmetrical. —ED.]

COMPOSITION.—Three analyses of senna have been made; viz. one in 1797, by Bouillon La Grange;[1] a second by Braconnot;[2] and a third, in 1821, by Lassaigne and Fenuelle:[3]—

SENNA LEAVES.			SENNA PODS.
Braconnot.		*Lassaigne and Fenuelle.*	*Fenuelle.*
Bitter matter of senna....	53·7	Cathartin.	Cathartin.
Reddish-brown gum......	31·9	Yellow colouring matter.	Yellow colouring matter.
Matter similar to animal mucus, precipitable by acids	6·2	Volatile oil.	Volatile oil.
		Fixed oil.	Fixed oil.
		Albumen.	Albumen.
Acetate of lime	8·7	Mucus.	Gum.
Malate (or some other vegetable salt) of lime ...	3·7	Malic acid.	Malic acid.
		Malate and tartrate of lime.	Malates of potash and lime.
Acetate of potash Chloride of sodium	...traces	Acetate of potash.	Mineral salts.
		Mineral salts.	Silicic acid.
		[Insoluble matter (lignin, &c.)]	Lignin.
Watery extract of Alexandrian Senna	104·2	Alexandrian Senna.	Legumes of Cassia acutifolia.

1. ODOROUS PRINCIPLE; *Volatile Oil of Senna.*—Obtained by submitting the leaves, with water, to distillation. It has a nauseous odour and taste. The distilled water of senna, which contains some oil in solution, acts as a mild purgative only.

2. CATHARTINE; *Purgative Principle of Senna*—Yellowish red, uncrystallisable, with a peculiar odour, and a bitter, nauseous taste; very soluble both in water and alcohol, but insoluble in ether; it attracts water from the air. Its aqueous solution is precipitated by infusion of galls and diacetate of lead. The sesquisulphate of iron and alkalies deepen the colour of the infusion: chlorine decolorises it: iodine, acetate of lead, gelatine, and emetic tartar, cause no precipitates with it. It appears to consist of *carbon*, *hydrogen*, and *oxygen* only. Three grains caused nausea, griping, and purging.

CHEMICAL CHARACTERISTICS.—By boiling senna in water,—by the exposure of infusion of senna to the air, as well as by the action of the mineral acids and of chlorine on the infusion,—a precipitate is procured. Bouillon La Grange regarded this as a species of resin, formed by the union of oxygen with a peculiar kind of extractive found in senna. This extractive, he says, is inert, but becomes active when converted into resin; and hence, the cold infusion, according to this chemist, causes colic, but rarely purges. The carbonated alkalies, lime water, nitrate of silver, the acetates of lead, sulphate of iron, &c., form precipitates with the infusion of senna.

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—In doses of five or six ounces it purges horses. Courten[4] threw an infusion into the veins of a dog; it quickened the respiration, and caused vomiting. The animal appeared weak, was dull, and had no inclination to eat.

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[1] *Ann. de Chim.* xxiv. 3.

[2] *Journ. de Phys.* lxxxiv. 281.

[3] *Ann. de Chim. et de Phys.* xvi. 16.

[4] Wibmer, *Wirkd. Arzneim. u. Gifte*, ii. 67.

β. On Man.—Regnandot[1] injected half a spoonful of weak lukewarm infusion of senna into the left medial vein of a young man affected with an herpetic eruption. The only effect produced was a slight temporary headache. Some days afterwards a spoonful was injected: in half an hour violent shivering and vomiting came on, which were followed by heat and purging. The febrile symptoms continued for several hours. Taken by the stomach senna acts as a sure and safe purgative. Its ill effects are nausea, griping, flatulence, and, at first, depression, afterwards excitement of the pulse. It appears to stimulate the abdominal and pelvic vessels, thereby having a tendency to promote the hemorrhoidal and menstrual discharges. It is one of the mildest of the drastic purgatives. Unlike scammony, gamboge, jalap, and most other drastics, it does not rank among poisons, even when given in large doses. It is distinguished from the saline purgatives by its stronger and more irritant operation, by the heat, gripings, and increased frequency of pulse, which attend its purgative action. From rhubarb it differs in being more powerful and irritant in its operation, in being nearly or quite devoid of any tonic operation. It acts more speedily and powerfully than aloes, and in a less marked manner on the large intestines. In its operation it appears to rank between jalap and aloes. The petioles and stalks possess similar properties to the leaflets. Formerly the griping quality of senna was ascribed to the stalks, but both Bergius[2] and Schwilgué[3] have proved the error of this notion. The legumes are much milder in their operation than the leaflets.

Good East Indian senna is almost, if not quite, as active as the Alexandrian. Mr. Twining,[4] after extensively trying it, declared it equal to the best he had ever seen. The obovate senna appears to be milder than the acute-leaved. The Senegal senna, before referred to, was found to possess less activity than ordinary senna. Part of the acrid and griping qualities of Alexandrian senna are referable to the argel leaves, which, according to the observations of Rouillure, Delile, Nectoux, and Pugnet (quoted by Delile), possess greater activity than the true senna leaves. Rouillure says they purge and gripe, and are used by the Arabs of Upper Egypt without the addition of senna. These effects might be expected from the known properties of Asclepiadaceæ (before referred to). "American senna is an efficient and safe cathartic, closely resembling the imported senna in its action, and capable of being substituted for it in all cases in which the latter is employed."[5]

If infusion of senna be given to the nurse, the suckling infant becomes purged,—a satisfactory proof that the cathartic principle of senna becomes absorbed, and is thrown out of the system by the excretories. Furthermore, as purging results from the injection of infusion of senna into the veins, this cathartic would appear to exercise a specific influence over the bowels, independent of its local action on these when it is swallowed.

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[1] Ibid. *op. supra cit.*

[2] *Mat. Med.* i. 354.

[3] *Traité de Mat. Méd.* ii. 410.

[4] *Trans. Med. and Phys. Soc. of Calcutta*, v. 433.

[5] *United States Dispensatory.*

USES.—Senna is well adapted for those cases which require an active and certain purgative, with a moderate stimulus to the abdominal and pelvic viscera. Thus, *in constipation* and *inactivity of the alimentary canal*, requiring the continued or frequent use of purgatives; *in worms; in determination of blood to the head*, and many other cases which readily suggest themselves, senna answers very well. The circumstances contraindicating its use are,—an inflammatory condition of the alimentary canal, a tendency to hemorrhoids or menorrhagia, threatening abortion, and prolapsus of the uterus and rectum. The objections to its use are,—the large dose required, the nauseous and disgusting flavour, the tendency to gripe, and the irritant and stimulant operation. Thus, in inflammation of the mucous membrane of the bowels, the irritant action of senna makes it an objectionable purgative; while its tendency to increase the frequency of the pulse renders it less fit for exhibition in febrile disorder than the saline purgatives. It is a very safe purgative, and may be given to children, females, and elderly persons, with great security. Though it is not the most appropriate purgative to be employed after delivery, and operations about the abdomen or pelvis (as hernia and lithotomy), yet I have repeatedly seen it used, and rarely with any unpleasant consequences.

ADMINISTRATION.—Powder of senna may be given in doses of from ʒss. to ʒij. for adults. There are two objections to its use,—the great bulk of the necessary dose, and the uncertainty of its operation, arising from its liability to decompose by keeping. To cover the unpleasant flavour of senna, Dr. Paris[1] recommends the addition of Bohea (black) tea: coffee has been advised by others. Aromatics (especially coriander and ginger) are frequently added to prevent griping, and to improve the flavour.

1. **INFUSUM SENNÆ**, E.; *Infusum Sennæ compositum*, L. D.; *Infusion of Senna; Senna Tea.*—(Senna leaves, ʒxv. [℥iss. *E.*, ℥ss. *D.*]; Ginger, bruised, ℈iv. [ʒss. *D.*]; Boiling [distilled, *L.*] Water, Oj. Macerate for an hour in a vessel lightly covered, and strain [through linen or calico, *E.*]).—An ordinarily used purgative, employed frequently in the maladies of children as well as of adults. A saline purgative (sulphate of magnesia or of soda, or potash-tartrate of soda, or tartrate of potash) is usually given in conjunction with it; manna and tincture of senna being frequently added. A compound of this kind is called the *black draught*.—The dose of infusion of senna is from f℥ij. to f℥iv. for adults. [In order to preserve this infusion in warm weather, Mr. Squire recommends the addition of one grain of nitrate of potash to each ounce.—ED.]

2. **INFUSUM SENNÆ COMPOSITUM**, E.; *Compound Infusion of Senna.*—(Senna, ʒj.; Tamarinds, ℥j.; Coriander, bruised, ʒj.; Muscovado Brown Sugar, ℥ss.; Boiling Water, f℥viij. Infuse for four hours, with

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[1] *Pharmacologia.*

occasional stirring, in a covered vessel, not glazed with lead; and then strain through linen or calico. This infusion may be likewise made with twice or thrice the prescribed quantity of senna.) — A vessel not glazed with lead is directed, lest the acid of the tamarinds should dissolve the metal of the glazing, and thereby give a noxious impregnation. This cathartic somewhat resembles Sydenham's *potio cathartica lenitiva.* The unpleasant flavour of the senna is agreeably covered by the tamarinds and sugar. This preparation is cathartic and refrigerant. It is employed as a cathartic in febrile disorders.—Dose, f℥ij. to f℥iv.

3. **ENEMA CATHARTICUM**, E. D.; *Cathartic Enema.*—(Olive Oil, ℥j.; Sulphate of Magnesia, ℥ss.; Sugar, ℥j.; Senna, ℥ss.; Boiling Water, f℥xvj. Infuse the senna for an hour in the water, then dissolve the salt and sugar; add the oil, and mix them by agitation, *E.* — The *Dublin College* employs of Olive Oil, f℥j.; Sulphate of Magnesia, ℥j.; Mucilage of Barley, f℥xvj. Dissolve the sulphate of magnesia in the mucilage; add the oil, and mix.)—Employed as a laxative. It is a constituent of the fetid clyster.

4. **TINCTURA SENNÆ COMPOSITA**, L. E. D.; *Tincture of Senna; Elixir Salutis.*—(Senna leaves, ℥iiiss.; Caraway seeds, bruised, ʒiiiss.; Cardamoms, bruised, ʒj.; Raisins [stoned], ℥v.; Proof Spirit, Oij. Macerate for seven days, and then press and strain, *L.* Senna, ℥iv.; Caraway seeds, bruised; Cardamom seeds, bruised, of each ℥ss.; Proof Spirit, Oij. Macerate for fourteen days, strain, express, and filter, *D.*—Sugar, ℥iiss.; Coriander, bruised, ℥j.; Jalap, in moderately-fine powder, ʒvj.; Senna, ℥iv; Caraway, bruised; Cardamom seeds, bruised, of each, ʒv.; Raisins, bruised, ℥iv.; Proof Spirit, Oij. Digest for seven days, strain the liquor, express strongly the liquor, and filter the liquids. This tincture may be more conveniently and expeditiously prepared by percolation, as directed for the compound tincture of cardamom. If Alexandrian senna be used for this preparation, it must be freed from Cynanchum [Argel] leaves by picking, *E.*) Carminative, cordial, stomachic, and purgative. Usually employed as an adjunct to the infusion of senna. If given alone as a purgative, the dose should be f℥ss. to f℥j. It is useful in costiveness attended with flatulence.

5. **SYRUPUS SENNÆ**, L. E.; *Syrup of Senna.*—(Senna, ℥iijss.; Fennel (seed), bruised, ʒx.; Manna, ℥iij.; Treacle, lbs. iij.; Boiling distilled Water, Oj. Macerate the senna and fennel in the water, with a gentle heat, for six hours. Mix the manna and treacle with the strained liquor, then boil down to a proper consistence, *L.*—Senna, ℥iv.; Boiling Water, Oj. and f℥iv.; Treacle, ℥xlviij. Infuse the senna in the water for twelve hours; strain, and express strongly through calico, so as to obtain a pint and two fluidounces at least of liquid. Concentrate the treacle in the vapour-bath as far as possible, or till a little taken out upon a rod becomes nearly concrete on cooling; and, while the liquor is still hot, add the infusion, stirring carefully and removing the vessel from the vapour-bath as soon as the mixture is complete. If Alexandrian Senna be used for this preparation, it must be carefully freed of

Cynanchum [Argel] leaves by picking it, *E.*)—Cathartic. Given to children in doses of fʒj. to fʒij.

6. CONFECTIO SENNÆ, L. D.; *Electuarium Sennæ,* E.; *Electuarium Lenitivum; Confection of Senna; Lenitive Electuary.*—(Senna, ℥viij.; Figs, lb. j.; Prepared Tamarinds; Prepared Cassia; Prepared Prunes, of each lb. ss.; Coriander, ℥iv.; Fresh liquorice, bruised, ℥iij.; Sugar, lb. iiss.; Distilled Water, Oiij. Rub the senna with the coriander, and by a sieve separate ten ounces of the mixed powder; then boil down the water, with the figs and liquorice added, to half, then express and strain. Evaporate the strained liquor in a water-bath, until of the whole, twenty-four fluidounces remain; then the sugar being added, let a syrup be made. Lastly, gradually rub the pulps with the syrup, and having thrown in the sifted powder, mix them all, *L.*—The *Edinburgh College* omits the Tamarind and Cassia pulps, but employs lb. j. of Prune pulp, and Oiij¼. of Water.—The *Dublin College* directs Senna leaves, in a very fine powder, ℥ij.; Coriander, in fine powder, ℥j.; Oil of Caraway, ʒss.; Pulp of Prunes, ℥v.; Pulp of Tamarinds, ℥ij.; Brown Sugar, ℥viij.; Water, f℥ij. Dissolve the sugar in the water, and beat the pulps with the syrup to a uniform consistence; having stirred in the powders and oil of caraway, mix all well together, and heat the mass thoroughly in a water-bath for ten minutes.)—The preparation of this compound being troublesome and expensive, and sophistications of it not being readily detectable, it is rarely prepared, in commerce, as directed by the London and Edinburgh Colleges. Jalap is frequently substituted, partially or wholly, for the senna and cassia pulp. Dr. Paris mentions walnut liquor as a colouring ingredient in use; and adds, that a considerable quantity of this confection is made in Staffordshire, in which unsound and spoilt apples enter as a principal ingredient. When properly prepared, it is a pleasant, mild, and very effectual purgative, and is frequently employed by pregnant women, persons afflicted with hemorrhoids or diseases of the rectum. When given alone in a full dose it is apt to gripe.—Dose, ʒj. to ʒvj. It is frequently employed as a vehicle for the exhibition of other cathartics; for example, bitartrate of potash.

[**7. EXTRACTUM SENNÆ FLUIDUM,** U. S. *Fluid Extract of Senna.*—Take of Senna, in coarse powder, lb. iiss.; Sugar, ℥xx.; Oil of Fennel, ʒj.; Compound Spirit of Ether, ʒij.; Diluted Alcohol, Oiv. Mix the senna with the diluted alcohol; and having allowed the mixture to stand for twenty-four hours, introduce it into a percolator, and gradually pour in water mixed with one third of its bulk of alcohol, until a gallon and a half of liquid shall have passed. Evaporate the liquid by means of a water-bath to twenty fluidounces, filter, then add the sugar, and when it is dissolved, the compound spirit of ether holding the oil of fennel in solution. This is a concentrated preparation of senna, convenient in consequence of the smallness of the dose, which is ʒj. to ʒij. It may be given by itself, or in combination, as the infusion.—ED.]

293. CASSIA FISTULA, *Linn. L. E. D.*—THE PUDDING-PIP TREE, OR PURGING CASSIA.

Cathartocarpus Fistula, *Persoon.*
Sex. Syst. Decandria Monogynia.
(Fructus, *L.*—Pulp of the pods, *E.*)

HISTORY.—The earliest writers in whose works we find the fruit of Cassia Fistula mentioned, are the Arabians, Mesue, Serapion, and Avicenna. The first Greek writer who notices it is Actuarius, who terms it κασσια μελαινα, or *black cassia.*[1]

BOTANY. **Gen. Char.**—See *Cassia* (p. 350).

Sp. Char.—*Leaflets* 4 to 6 pairs, ovate, somewhat acuminate, smooth; *petioles* glandless. *Racemes* lax, without bracts. *Legumes* terete, straight, somewhat obtuse, smooth (De Cand.)

Tree from 20 to 30 feet high. *Leaves* alternate, pinnate, from 12 to 18 inches long; *leaflets* from 2 to 6 inches long, and from 1 and a half to 3 inches broad. *Stipules* minute. *Racemes* 1 to 2 feet long. *Flowers* large, bright-yellow, fragrant, on long footstalks. *Legume* cylindrical, ligneous, 1 or 2 feet long, externally blackish-brown; with three longitudinal bands or seams extending the whole length, two of which by their contiguity appear to form a single one, the third being on the opposite side of the legume; internally divided into numerous cells by thin transverse partitions or phragmata, formed by the distension of the placenta, and therefore called spurious dissepiments. *Seed* 1 in each cell, surrounded by a soft blackish pulp, which appears to be a secretion of the endocarp or inner coat of the pod.

Hab.—East Indies, Egypt. Introduced into the West Indies.

DESCRIPTION.—The pods of Cassia Fistula (*cassia fistula; legumen cassiæ fistulæ*) are imported from the East Indies (Madras and Ceylon), from the West Indies (Barbadoes), and from South America (Carthagena and Savanilla). Their botanical description has been above given. Their *pulp* (*pulpa cassiæ fistulæ; pulpa leguminis cassiæ fistulæ*) is reddish-black, with a sweetish taste. By exposure to the air it becomes acid, in consequence of undergoing the acetous fermentation. Those pods yield the most pulp which are heavy, and do not rattle when shaken. [The West Indian contains much more pulp, and is therefore much more valuable, than that from Madras, which consists of thin and in many instances dried-up pods, fetching generally only half the price of the former.—ED.]

SMALL AMERICAN CASSIA FISTULA; *Petite Casse d'Amérique*, Guibourt.—*Pods* twelve to eighteen inches long, and six lines in diameter, pointed at the extremities. *Pericarp* thinner than the ordinary Cassia fistula. *Pulp* reddish-brown, acerb, astringent, sweet. Is this pod the fruit of *Cathartocarpus bacillaris*, a native of the Caribæan Islands, depicted in Jacquin's *Fragm. Bot.* Tab. 85?

The pulp of CASSIA BRASILIANA has been employed in America. The pods are from 18 to 24 inches long, ligneous, and rough, with very prominent sutures.

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[1] Lib. v.

COMPOSITION. — Vauquelin[1] and N. E. Henry[2] have analysed Cassia pulp.

Vauquelin's Analysis.

Pericarp		35·15
Phragmata		7·03
Seeds		13·28
Pulp	Sugar	14·85
	Gum	1·56
	Extractive	0·51
	Vegetable jelly	0·13
	Glutinous matter	0·79
	Woody fibre	2·35
	Water	21·35
Cassia pods		97·00

N. E. Henry's Analysis.

	Common or African.	American.
Sugar	61·00	69·25
Gum	6·75	2·60
Matter possessing many properties of tanning substances	13·25	3·90
Do. having some properties of gluten	traces	traces
Colouring matter soluble in ether	small quan.	none
Loss, principally owing to water	19·00	24·25
Watery extract of Cassia pulp	100·00	100·00

PHYSIOLOGICAL EFFECTS. — Cassia pulp in small doses is a mild laxative; in large doses a purgative; but it is apt to occasion nausea, flatulence, and griping. Manna is said singularly to exalt the purgative effect of Cassia pulp.[3] Thus Valisnieri states, that twelve drachms of this pulp are about equivalent in purgative strength to four ounces of manna; but that if we give eight drachms of Cassia pulp, in combination with four drachms of manna, we obtain double the effect! But the correctness of such a statement is not supported by any evidence yet adduced.

USES. — It is rarely or never given alone; but the cases for which it is well adapted are febrile and inflammatory affections. On account of its pleasant taste it would be a convenient purgative for children.

ADMINISTRATION. — Dose, for an adult, of the pulp, as a mild laxative, ʒj. to ʒij.; as a purgative, ℥j. to ℥ij.

[1. **CASSIA PREPARATA**, L. (Cassia broken lengthwise, lb. j.; Distilled water sufficient to cover the Cassia. Macerate for six hours, occasionally stirring; strain the softened pulp through a hair sieve, and evaporate to the consistence of a confection by a water-bath.—ED.]

2. **CONFECTIO CASSIÆ**, L.; *Confection of Cassia.* (Prepared Cassia, lb. ss.; Manna, ℥ij.; Prepared Tamarind Pulp, ℥j.; Syrup of Rose, f℥viij. Bruise the Manna, then dissolve it in the Syrup; afterwards mix in the Cassia and Tamarind pulps, and evaporate the moisture until a proper consistence is attained). — Laxative. Occasionally used for children, as a vehicle for some more active substance.—Dose, ʒij. to ℥j. for adults.

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[1] *Ann. de Chim.* vi. 275.

[2] *Journ. de Chim. Méd.* ii. 370.

[3] See Paris, *Pharm.* 6th edit. i. 271.

294. COPAIFERA MULTIJUGA, *Hayne, L.*—VARIOUS SPECIES, *D. E.*

Copaifera multijuga et aliæ species, *De Cand.*—Copaifera officinalis, *Linn.*
Sex. Syst. Decandria Monogynia.
(Oleo-resina, *L. D.*—Fluid resinous exudation, *E.*)

HISTORY. — The first notice of Copaiva balsam, as well as of the tree yielding it, was given by Piso.[1] Hayne[2] is of opinion that the *Copaifera bijuga* is the species observed by Piso.

BOTANY. **Gen. Char.** — *Calyx* ebracteolate, of 4 spreading, small, equal sepals united at the base. *Petals* 0. *Stamens* 10 distinct, nearly equal; *anthers* oblong. *Style* filiform. *Legume* stalked, obliquely elliptical, coriaceous, somewhat compressed, 2-valved, with 2 ovules, 1-seeded. *Seed* elliptical, inclosed in a baccate aril. *Embryo* straight; *radicle* somewhat lateral. — *Trees. Leaves* abruptly pinnate. *Leaflets* coriaceous, somewhat unequal, ovate. *Flowers* paniculate (De Cand.)

Species.—1. C. MULTIJUGA, Hayne, L.—*Leaflets* 6 to 10 pairs, ovate-lanceolate, acuminate, mucronate, with pellucid dots. *Petiole* slightly hairy. — In the province of Para the greatest quantity of the balsam is furnished by this species (Hayne).

2. C. LANGSDORFII, Desf. L. — *Leaflets* 3 to 5 pairs, ovate or oval, blunt, equal-sided, with pellucid dots. *Petioles* and *peduncles* slightly downy. — This and the following species furnish the balsam collected by the natives of Santa Paulo.

3. C. CORIACEA, Mart. — *Leaflets* 2 to 3 pairs, elliptical, equal-sided, emarginate, coriaceous, not dotted, reticulated, smooth on both sides, somewhat glaucous beneath. *Petioles* and *peduncles* almost smooth. — Bahia. It yields balsam of copaiva in Santa Paulo.

4. C. OFFICINALIS, Linn. D.; *C. Jacquini*, Desf. — *Leaflets* 2 to 5 pairs, incurved, ovate, unequal-sided, obtusely acuminate, with pellucid dots. — Venezuela, near Calaboso, West Indies. — An inferior kind of balsam is said to be obtained from this species.

The following are species of Copaifera described by Hayne: —

5. C. BEYRICHII, Hayne. — Mandiocca, in the Brazils.
6. C. GUIANENSIS, Desf. — Guiana, near Rio Negro.
7. C. MARTII, Hayne. — Para.
8. C. BIJUGA, Willd. — Brazils.
9. C. JUSSIEUI, Hayne. — Brazils.
10. C. NITIDA, Mart. — Brazils (Minaes Geraes).
11. C. LAXA, Hayne. — Brazils.
12. C. CORDIFOLIA, Hayne. — Brazils.
13. C. SELLOWII, Hayne. — Brazils.
14. C. OBLONGIFOLIA, Mart. — Brazils (Minas Geraes).

EXTRACTION OF THE BALSAM. — The balsam is obtained by making incisions into the stems of the trees. It exudes so abundantly that, at the proper season, twelve pounds are sometimes obtained in the space of

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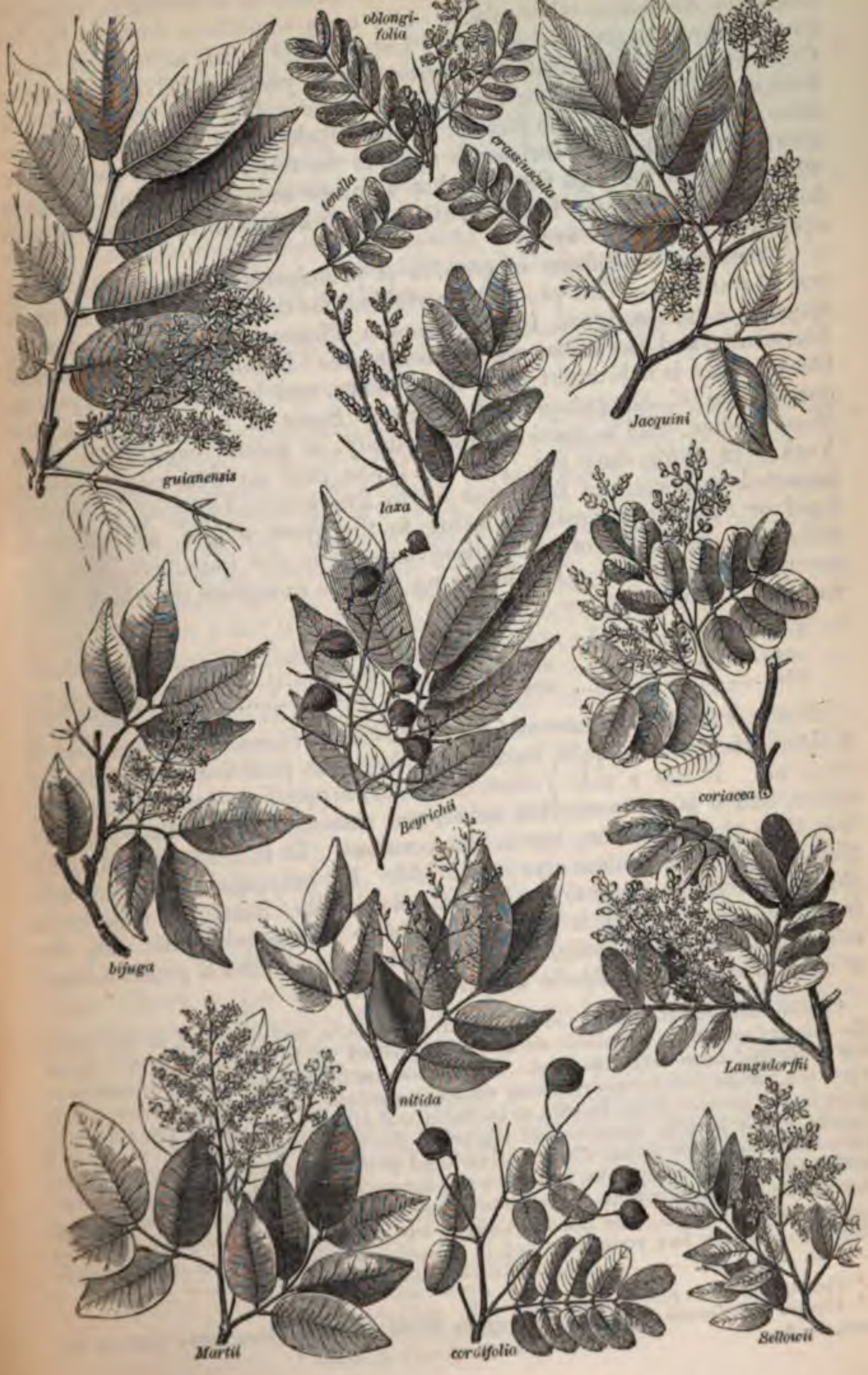
[1] *Med. Bras.* lib. iv. cap. 4; in *Hist. Nat. Bras.* Lugd. 1648.
[2] Duncan, *Suppl. to the Edinb. New Disp.* p. 45.

FIG. 68.


oblongifolia
tenella
crassiuscula
Jacquini
guianensis
laxa
coriacea
Beyrichii
bijuga
nitida
Langsdorffii
Martii
cordifolia
Sellowii

three hours.[1] If, however, no balsam should flow, the wound is immediately closed with wax or clay, and re-opened in a fortnight, when an abundant discharge takes place. Old trees sometimes furnish balsam two or three times in the year. Langsdorff,[2] in his account of Santa Catherina, observes that "the tree which yields copaiva balsam, or balsam of Tolu, *Copaifera officinalis*, is here called *oleo breto*, or black olive. It abounds in the forests, but very little use is made of it. I was assured, that when the incision is made in the tree to procure the balsam, which is done only in the very hot summer months, a strong sound is heard, and the sap or balsam rushes out in a stream, as when a vein is opened in the human arm.

COMMERCE. — Balsam of copaiva is principally obtained from Para and Maranham. This probably is yielded, for the most part, by *C. multijuga*, the tree assigned in the London Pharmacopœia. Carthagena, Maracaibo, and Savanilla, also furnish some. Is this from *C. officinalis*? Occasionally it is brought from Rio Janeiro, and is there probably procured from *C. Langsdorfii* and *coriacea*. Some is imported from the West Indies; and a considerable quantity, at second hand, from New York. In 1839, duty (4s. per cwt.) was paid on 643 cwts. [It is imported in barrels of from one up to five hundredweight, on which fixed or customary tares, according to the gross weight, are allowed, which are generally of great disadvantage to the importers, and the reverse to the buyers. The following are the quantities on which duty was paid for six years: —

1839	643 cwt.	1842	648 cwt.
1840	870 „	1843	715 „
1841	652 „	1844	645 „ ED.]

DESCRIPTION.—Balsam of Copaiva (*Balsam Copaivæ* seu *Copaibæ*) is a clear transparent liquid, having for the most part the consistence of olive oil. It has a pale yellowish colour, a peculiar, not disagreeable odour, and a bitter somewhat acrid, and nauseous taste. Its sp. gr. is less than that of water, but is not constant. It is 0·95 according to Schönberg, while Stoltze says it is 0·966. By keeping, it becomes considerably denser, owing to the loss of volatile oil. Balsam of copaiva is insoluble in water, but is completely soluble in alcohol, ether, and the oils, both fixed and volatile. When acted on by alkalies it yields a kind of soap, which is insoluble in water.

Considerable variation exists in the colour, consistence, and sp. gr. of, as well as in the relative quantities of volatile oil and resin yielded by, balsam of copaiva. Even the odour and taste vary somewhat. The differences doubtless depend in great part upon the balsam being procured from different species. The smaller species, which grow in the interior of the Brazils, as in Bahia and Minas, yield, as we are told, less balsam, but it is more resinous and sharper. *Brazilian Copaiva* is thin, clear, and pale-coloured. *West Indian Copaiva* (produced probably by *C. officinalis*) is thick, golden-yellow, not transparent, and has a less agreeable smell, which is somewhat like that of turpentine. [It is to be regretted that the term balsam is still erroneously applied to this liquid. The London College has more correctly described it as an oleo-resin; it is in fact resin dissolved in essential or volatile oil like ordinary turpentine. It contains no benzoic acid, which has generally been regarded by pharmacologists as a necessary constituent of a substance to which the term balsam is applied. —ED.]

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[1] Piso, *op. supra cit.* p. 56.

[2] *Voyages and Travels in Various Parts of the World during the Years* 1803—1807, p. 43, Lond. 1813.

ADULTERATION. — There is no reason to suppose that balsam of copaiva is adulterated in this country now; though the following fact, mentioned by Dr. Paris,[1] proves that formerly it was. "A curious trial took place some time since, between the owners of certain premises that were burnt down, and the Governors of the Sun Fire-Office, in consequence of the latter refusing to indemnify the proprietor for his loss, because the fire had been occasioned by his *making* Balsam of Copaiba." — Gray[2] has published formulæ for making a *balsamum copaibæ reductum*, as well as *copaiba factitia*. — The *Edinburgh College* gives the following characters of the purity of the Balsam: —

> "Transparent: free of turpentine odour when heated: soluble in two parts of alcohol: it dissolves a fourth of its weight of carbonate of magnesia, with the aid of a gentle heat, and continues translucent."

The turpentine odour may be recognised by dropping the suspected balsam on a heated iron (as a spatula). The mixture of magnesia and copaiva here referred to, acquires, in several hours, the translucency, aspect, and consistency of very thick mucilage of gum arabic. This test was proposed by Blondeau.[3] If one or two drops of suspected balsam be placed on unsized paper, and carefully heated over a lamp to expel the volatile oil, an homogeneous translucid spot is left, if the balsam be pure; but if it have been mixed with castor oil, the spot of resin is surrounded by an oily areola.[4] Planche[5] has recommended ammonia as a test. If pure balsam be shaken with liquor ammoniæ (sp. gr. 0·965) it becomes clear and transparent in a few instants; not so when castor oil is present. Ebullition with water (to expel the volatile oil and obtain the hard resin), and the action of potash, and of sulphuric acid, have also been proposed as tests.

[Mr. Daniel Hanbury has lately directed attention to the fact that there is a liquid found in the London market, and offered for sale under the name of Balsam Copaiva, which is imported in considerable quantity from Moulmein in Burmah. In India it is known under the name of *Gurgina Balsam* or *Wood Oil*. It is the product of the *Dipterocarpus turbinatus*, an immense tree growing in Chittagong, Tipperah, Pegu, and other places to the eastward of Bengal. It presents so remarkable a resemblance to Balsam of Copaiba, that it might easily be mistaken for Copaiba of an unusually dark colour.

Wood Oil, as imported from Moulmein, is, after filtration, a transparent dark brown liquid, of somewhat greater consistence than Olive Oil, a sp. gr. of ·964, and an odour and taste like copaiba, though perhaps hardly so strong. One part of it treated with two parts of alcohol sp. gr. ·796, is dissolved with the exception of a minute quantity of darkish flocculent matter, which subsides upon repose. Its most curious property (as noticed by Mr. Charles Lowe with reference to a liquid which Mr. Hanbury supposed to have been *Wood Oil*[1]) is that exhibited when it is heated in a *corked* vial to about 266° F. (130° C.).[2] Thus treated, it becomes slightly turbid, and so gelatinous that the vial may be inverted, even while hot, without its contents being displaced; and on cooling, the solidification is still more complete. Gentle warmth and agitation restore to a great extent its fluidity, but solidification is again produced upon the liquid being heated to 266°. Copaiba displays no such phenomenon. According to Dr. O'Shanghnessy, when Wood Oil is heated in a retort, a yellowish white, *crystallisable*, solid substance having many of the properties of benzoic acid sublimes into the upper part of the vessel, to the extent of about one per cent. of the Wood Oil taken. In Mr. Hanbury's experiments none of this substance could be detected. It is true that when Wood Oil is heated, a scanty, opaque white sublimate condenses in the cooler part of the vessel, but this appears to arise from the condensation of a little water among the minute drops of essential oil, since it is not produced if the Wood Oil has been previously agitated with some fragments of dried chloride of calcium.

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[1] *Pharmacologia*, 6th edit. ii. 183.

[2] *Suppl. to the Pharm.*

[3] *Journ. de Chim. Méd.* i. 560; and ii. 41.

[4] Chevallier, *Journ. de Chim. Méd.* iv. 619.

[5] *Journ. de Pharm.* xi. 228.

With regard to its *medicinal properties*, there appears to be no doubt from an extensive set of experiments instituted by Dr. O'Shaughnessy, confirmed by trials made by other practitioners in India, that Wood Oil is nearly equally efficient with Copaiba, in the diseases in which that drug is indicated.[3] It may be administered as an emulsion, or in pills made up with magnesia. Dr. O'Shaughnessy has used the essential oil in doses of from 10 to 30 drops. From the close similarity of Wood Oil to Copaiba, a mixture of the two may be anticipated; from pure Copaiba, such a mixture will probably be known by a difference in its optical properties.—ED.]

COMPOSITION.—F. Hoffman[4] submitted copaiva to a chemical examination. Afterwards Schönberg[5] analysed it. In 1826, Stoltze,[6] and, in 1829, Gerber,[7] submitted it to analysis.

	Stoltze's Analysis.	*Gerber's Analysis.*	
		Fresh Balsam.	Old Balsam.
Volatile oil	38·00	41	31·70
Yellow dark resin (*copaivic acid*)	52·75	51·38	53·68
Brown soft resin	1·66	2·18	11·15
Water and loss	7·59	5·44	4·10
Balsam of Copaiva	100·00	100·00	100·63

1. VOLATILE OIL (see *post*).

2. RESIN OF COPAIVA (*Resina Copaibæ*).—After the balsam has been deprived of its volatile oil by distillation, a brownish resinous mass is left behind. This, when gently heated to expel the residual water, is sold as *resin of copaiva*. It consists of two resins—one called *copaivic acid*, the other the *viscid resin of copaiva*. They are separated by rectified spirit, which dissolves the acid resin, but leaves the viscid one.

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[1] On a new variety of Balsam of Copaiba, *Pharmaceutical Journal*, vol. xiv. pp. 65, 66.

[2] Mr. Lowe says 230° F., but a much more striking effect is produced on the Wood Oil by the temperature above named.

[3] *Bengal Dispensatory* (1842), pp. 222—224.

[4] *Obs. Phys. Chym.* lib. i. obs. 6; *Op. omn.* iv. 454, Gen. 1748.

[5] Pfaff, *Mat. Med.* iv. 12.

[6] *Berl. Jahrb.* xxvii. 2, 179.

[7] *Journ. de Pharm.* xvi. 79 and 367.

α. *Copaivic Acid; Yellow Brittle Resin of Copaiva.*—One hundred parts of balsam yield, on an average, fifty parts of this acid. Copaivic acid is an amber-coloured, brittle, crystallisable resin, soluble in alcohol, rectified spirit, ether, and the volatile and fixed oils. It is decomposed by sulphuric and nitric acids. Its acid properties are proved by its alcoholic solution reddening litmus, and by the definite compounds (*copaivates*) which it forms with bases. Thus, if an alcoholic solution of nitrate of silver be dropped into the alcoholic solution of this resin, we obtain, on the addition of a little ammonia, a white crystalline precipitate (*copaivate of silver*), slightly soluble in alcohol, and composed of one atom copaivic acid, and one atom oxide of silver. In the same way we may form the analogous *copaivates of lead* and *lime*. The *copaivates* of *potash* and *soda* are soluble, and have a bitter taste and a disagreeable odour: they are easily decomposed by acids. The *copaivate of ammonia* is soluble in ether and alcohol, but not in water. The *copaivate of magnesia* is prepared by adding copaivate of potash to sulphate of magnesia.

Copaivic acid is isomeric with pinic acid; that is, its composition is $C^{40}H^{32}O^{4}$ (Rose).

β. *Viscid Resin of Copaiva; Brown Soft Resin of Copaiva.*—When a hot alcoholic solution of copaiva cools, it retains in solution the acid resin already described, but deposits a brown viscid substance, which is termed the *viscid resin of copaiva*. As it is more abundant in old than in recent balsam, Gerber regards it as produced by some alteration of the acid resin. It is soluble in anhydrous alcohol and ether, and in the volatile and fixed oils. It has very little affinity for basic substances. One hundred parts of balsam contain from 1·65 to 2·13 per cent. of this resin.

PHYSIOLOGICAL EFFECTS.—Copaiva produces the general and topical stimulant effects of the oleo-resins, already described. Taken in *moderate* doses it creates a sensation of warmth in the stomach, gives rise to eructations having the odour of the balsam, and not unfrequently occasions nausea, or even actual vomiting. The continued use of it often impairs the appetite, and disorders the digestive functions. These may be regarded as the local effects on the stomach. The constitutional effects, or those which result from the absorption of the balsam, or of its active constituent, the oil, are those of a stimulant whose influence is principally directed to the secreting organs, more especially to the mucous membranes and to the urinogenital apparatus. The oil passes out of the system in part by the lungs, and the odour of its vapour is readily detectable in the breath of persons taking it. The urine is increased in quantity and altered in quality: thus its colour is heightened, its odour becomes balsamic, and its taste bitter; moreover, not unfrequently it is turbid, as if containing mucus.

[It has been proved that the oleo-resinous matter of copaiva enters the urine, and causes the secretion to simulate an albuminous condition, inasmuch as it becomes precipitable by nitric acid. It is important to remember this in a pathological point of view. The precipitate may be distinguished from that of albumen by the fact of its not subsiding as albumen does after the fluid has been set aside for a few hours.[1]—ED.]

The influence of copaiva over the mucous membrane lining the urethra, is shown, even in the healthy state, by the warmth and tickling sometimes experienced in this part, both before and after evacuating the urine, as observed by König, a medical student,[2] in his experiments with this medicine; and also by the marked influence which the balsam has in mucous discharges from this membrane—an influence familiar to every tyro in medicine. Furthermore, it is said occasionally to have produced unpleasant irritation of the testicles, though I have never observed this. It also acts as a stimulant, but in a less marked manner, to other mucous membranes; namely, the bronchial and gastro-intestinal membranes. The greater influence of copaiva over the urethral than over other mucous membranes is by some explained thus:—Besides the influence which this receives in common with the other membranes of the same class, by the general circulation, it is exposed to the local action of copaiva contained in the urine as this fluid is expelled from the bladder. If this hypothesis were correct, the influence of copaiva over the mucous lining of the bladder would be greater than that over the urethral membrane. Not unfrequently it gives rise to an eruption, usually of a scarlet colour, referable to either urticaria or erythema, though some describe it as being miliary. Vesicular eruptions are also spoken of, but I have never seen them. Mr. Judd[1] has depicted two eruptions caused by the balsam:—one he calls *small puniceous patch eruptions;* the other was a *papular eruption.* Rheumatism has also been ascribed to the use of the balsam.[2]

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[1] Rees *On Analysis and on the Treatment of Urinary Diseases*, p. 204.
[2] Wibmer, *Wirk. d. Arzneim. u. Gifte*, i. 484.

Large doses of copaiva irritate the gastro-intestinal canal, and occasion a sensation of heat at the pit of the stomach, nausea, vomiting, loss of appetite, and purging, with, not unfrequently, griping pains of the bowels. The whole system becomes powerfully stimulated; the pulse is fuller and more frequent, the skin hotter, and thirst and headache are produced. Occasionally, hæmaturia and dangerous ischuria are brought on. "I saw," says Kraus,[3] "a very dangerous case, of thirty-six hours' standing, almost instantaneously relieved by the application of a warm poultice (made of four ounces of the hyoscyamus plant) over the genital organs." The same author also says that the repeated use of large doses occasions, "in young marriageable subjects, a measle-like eruption over the whole body, which I have many times seen treated by pretended great diagnosticans (*Diagnostikern*) as true measles."

In one case[4] pain at the stomach, general uneasiness, and epileptic convulsions, followed, and were ascribed to, the use of copaiva. But the correctness of ascribing the convulsions to the use of the copaiva appears very doubtful.

When we compare the operation of copaiva with that of other agents possessing powers of a somewhat similar kind, we observe that both in local and constitutional effects it is more powerful than the balsams properly so called (that is, the native oleo-resins which contain benzoic acid), while its operation on the urino-genital organs is much more marked. It forms an intermediate substance between the balsams and the turpentines, being less powerful, but more aromatic, than the latter: yet, observes Ribes,[5] the turpentines are less successful in gonorrhœa. The same author considers it to be less powerful than balsam of Mecca, but more so than balsam of Canada.

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[1] *Pract. Treat. on Urethritis and Syphilis*, Lond. 1836.

[2] *Brit. and For. Med. Rev.* viii. 280; and *Lancet*, vol. ii. for 1837–8, p. 826.

[3] *Heilmittellehre*, 621, Gött. 1831.

[4] *Brit. and For. Med. Rev.* ix. 270.

[5] Quoted by Bayle, *Bibl. Thérap.* i. 363.

USES.—The principal employment of copaiva is in *mucous discharges from the urino-genital organs*, more epecially in gonorrhœa. There are two methods of treating this disease by copaiva: one is, not to exhibit the balsam until the inflammatory symptoms have subsided,—the other is to give it at the very outset, in order to cut short or suppress the disease. The *first* method is that followed by the best English and German surgeons. It consists in employing, during the violence of the inflammatory stage, antiphlogistic and soothing measures; and when the inflammation has quite or nearly subsided, or is of a very mild character, giving copaiva with the view of diminishing or stopping the discharge. This is the plan recommended by Hunter,[1] and the same practice is recommended in the published lectures of Sir Astley Cooper[2] and Mr. Lawrence.[3] It is undoubtedly the safest method of treatment; for although copaiva may sometimes, or even frequently, be exhibited during the acute or inflammatory stage of gonorrhœa, not only with impunity, but even with advantage, there is no denying the fact that it has, occasionally at least, aggravated the symptoms. This, indeed, is admitted by Ansiaux,[4] one of the principal supporters of the other plan of treatment. Many practitioners judge of the propriety of exhibiting the balsam by the quality of the discharge only, and refrain from administering this medicine until the discharge has acquired what is called a gleety character. I believe most prudent surgeons consider the existence of much pain or scalding in passing the water, an irritable condition of bladder, or violent chordee, as contraindicating the use of copaiva; while the absence of these symptoms may be regarded as permitting or indicating it.

The *second* method of treating gonorrhœa by copaiva consists in exhibiting this medicine in large doses at the commencement of the disease; that is, in its acute stage, usually without adopting any preliminary antiphlogistic or soothing measures. In America the practice is not new; but in Europe it has been recommended or adopted to any extent only since the commencement of the present century, and principally by the recommendations of Ansiaux, Ribes, and Delpech.[5]

Ansiaux candidly admits that in some cases the practice has been injurious; in one instance he saw it produce acute pain, irritable bladder, and discharge of blood by the urethra. The second of these writers seems to regard copaiva as a specific for gonorrhœa and all its consequences, including swelled testicle, dysury, ischury, cystitis, and nephritis! Delpech speaks of its use in a much more guarded manner: he employs leeches, and the usual antiphlogistic measures, when the inflammatory symptoms are very severe; but when the inflammation is not excessive, he commences at once with the balsam. In fact, his practice approximates very much to that usually followed in this country and Germany. The partisans of this second method of treating gonorrhœa say, that both copaiva and cubebs cure more easily and promptly, and with less chance of relapse, the sooner they are exhibited after the commencement of the disease; in other words, old claps are less readily cured by them than recent ones.

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[1] *Treat. on the Vener. Dis.*

[2] *Lancet*, iii. 199.

[3] *Lond. Med. Gaz.* v. 813.

[4] *Mém. sur le Traitem. de la Blennorrh.*; quoted by Bayle, *op. supra cit.* 348.

[5] Bayle, *op. supra cit.*

It has been stated by Delpech and Ricord—and I believe the experience of most practitioners bears out their statement—that copaiva is less successful in the gonorrhœa of females than in that of males. Trousseau and Pidoux[1] have endeavoured to account for this by saying that in the female gonorrhœa is not confined to the mucous lining of the urethra (on which the influence of copaiva is principally exercised), but extends to that of the vagina.

Velpeau[2] employs lavements of the balsam in gonorrhœa. By this mode of exhibition the nausea and vomiting which copaiva is apt to occasion, when taken by the mouth, are entirely obviated. Velpeau asserts, that by this mode of administration blennorrhagic discharges of both males and females are almost always diminished, and frequently completely stopped. He found the same practice useful in non-venereal puriform discharges from other mucous membranes. Indeed, he asserts that copaiva lavements may in all cases be substituted for the administration of this liquid by the mouth.

In *chronic inflammation of the bladder* (commonly termed *cystirrhœa*, or *catarrhus vesicæ*) copaiva has at times been found beneficial.[3] Delpech relates a case of *acute* vesical catarrh cured by it. But catarrhus vesicæ is for the most part accompanied with considerable irritation, which is in general greatly increased by stimulants like copaiva.

In *leucorrhœa* copaiva has been employed with some advantage. Favourable reports of this practice have been published by Cuttet and Lacombe,[4] Armstrong,[5] and others.

In *chronic pulmonary catarrh* its employment has been spoken of favourably. Armstrong,[6] Hallé, Bretonneau, and La Roche (quoted by Bayle), have borne testimony to its good effects. It is only adapted for chronic, or old-standing cases, and for torpid habits. Its stimulant influence is calculated to be very injurious where there is inflammation or febrile disorder. Dr. Fothergill[7] has very properly reprobated the practice of administering it in pulmonary consumption, as recommended by Fuller and others. [Sausserotte has found it of great service in subacute bronchitis, accompanied by an exhausting mucopurulent expectoration, and also in bronchorrhœa.[8]—Ed.]

In *chronic inflammation of the mucous membrane of the bowels*, especially of the colon and rectum, copaiva has been used.[9] Dr. Cullen[10] spoke favourably of its use in *hemorrhoids*. "I have learned from an empirical practitioner," he says, "that it gives relief in hemorrhoidal affections; and I have frequently employed it with success. For this purpose it is to be given in doses of from 20 to 40 drops, properly mixed with powdered sugar, once or twice a day."

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[1] *Traité de Thérap.* i. 494.
[2] *Rech. sur l'Emploi du Baume de Copahu.*
[3] La Roche, *Amer. Journ. of the Med. Sciences*, xiv. 13.
[4] Bayle, *op. supra cit.*
[5] *Pract. Illustr. of the Scarlet Fever*, &c. 1818.
[6] *Op. supra cit.*
[7] *Med. Obs. and Inq.* iv. 231.
[8] *Annuaire de Thérapeutique*, 1856, p. 94.
[9] La Roche, *Lond. Med. Gaz.* ii. 31, new series.
[10] *Mat. Med.*

It was formerly employed as a *topical application* to wounds and ulcers.

ADMINISTRATION.—Dose, from gtt. xx. to fʒj., or even more. It is sometimes taken on sugar, and this is said to be the most efficacious method of giving it, in affections of the urinary organs; but its nauseous taste is a great objection to its employment in this way. Some take it *swimming on half a wine-glassful of water*, to which a few drops of some bitter tincture have been added. Many persons employ it in the form of *emulsion* (made with mucilage, yolk of egg, or alkalies). If mucilage be employed, it should not be very thick, otherwise it will not mix well. Spirit of nitric ether is frequently added to cover the unpleasant flavour. Opium is sometimes conjoined to counteract purging, and acids (especially the sulphuric) to check nausea. *Syrup of copaiva* (prepared by rubbing ℥iv. of balsam with 32 grs. of calcined magnesia, and then adding 64 drops of oil of peppermint and 62 ozs. of simple syrup) has been recommended.[1] Balsam of copaiva has also been taken in the form of *pills;* various powders (starch, gum, rhubarb, magnesia, &c.) being employed to give it a proper consistence. If magnesia be employed (as recommended by Mialhe), the copaivic acid unites with it, and thereby forms copaivate of magnesia, which has considerable consistence, and absorbs the volatile oil. In some cases the balsam acquires, by magnesia, a pilular consistence; but frequently it does not become thicker than honey. Bordeaux turpentine also possesses the property of solidifying with magnesia. The following is a formula for *copaiva pills*:[2]—Balsam of Copaiva, ℥j.; Calcined Magnesia, ʒvj. or ʒvij. (or common Carbonate of Magnesia, ℥j.) Several hours are frequently required to effect the solidification of the balsam.—Velpeau's *copaiva lavement* is thus prepared:—Balsam of Copaiva, ʒij.; Yolk of one Egg; Distilled Water, f℥viij. Make an emulsion, and to which add Tincture of Opium, gtt. xx. or gtt. xxx.

The resin of copaiva, which was much extolled a few years since,[3] is the least active part of the balsam.

1. OLEUM COPAIBÆ, E.; *Essential Oil of Copaiva.*—(Copaiva, ℥j.; Water, Oiss. Distil, preserving the water; when most of the water has passed over, heat it, return it into the still, and resume the distillation; repeat this process so long as a sensible quantity of oil passes over with the water.)—The directions of the *Edinburgh College* make the process of obtaining the oil a more operose one than it really is. Mr. Whipple informs me, that from 249 lbs. of balsam he obtained 128 lbs. of volatile oil and 120 lbs. of resin. Ader[4] has published a method for procuring the oil without distillation; but the process is more expensive, while the oil obtained by it is impure, owing to the presence of a little resinous soap.

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[1] *Lond. Med. Gaz.* ii. 864, new series.

[2] Soubeiran, *Traité de Pharm.* i. 523.

[3] Thorn, *Observ. on the Treat. of Gonorrhœa by a new Prepar. from the Bals. of Copaiba*, 1827.

[4] *Journ. de Pharm.* xv. 95.

When oil of copaiva has been rectified, and afterwards freed from water by digesting it on chloride of calcium, it has a specific gravity of 0·878. It is colourless, and has an acrid taste, and an aromatic, peculiar odour. Sulphuret of carbon and sulphuric ether dissolve it in all proportions; absolute alcohol dissolves two-fifths its weight of it; ordinary rectified spirit takes up less than this. Potassium may be preserved in it unchanged, showing the absence of oxygen. It dissolves sulphur, phosphorus, and iodine (by the latter it is coloured), and absorbs chlorine, with which it becomes turbid and viscid. When dropped on iodine, heat and hydriodic acid are suddenly produced.

Sulphuric and nitric acids convert it into a resinous substance. When hydrochloric acid gas is passed into this oil, crystals of the *hydrochlorate of the oil of copaiva* (or *artificial camphor of the oil of copaiva*) are deposited, while a fuming oily product, saturated with acid, remains. Hence, therefore, it is probable that oil of copaiva, like the oil of turpentine, consists of at least two isomeric oils; one, which forms the crystallisable compound with hydrochloric acid; the other, which does not form this crystalline matter.

Oil of copaiva is isomeric with oil of turpentine,—that is, it consists of $C^{10}H^{8}$.

For medicinal use I prefer the oil of copaiva to any other preparation of the balsam. The usual dose is from ten to twenty drops, which may be gradually increased; but I have known f℥ij. taken at one dose without any ill effects. It may be taken on a lump of sugar.

[2. **PILULÆ COPAIBÆ,** U. S.; *Copaiba Pills.* (Take of Copaiba, ℥ij.; Magnesia, recently prepared, ʒj. Mix them, and set aside until it concretes into a pilular mass, which is to be divided into 200 pills.) This preparation affords a convenient mode of giving copaiba.—Dose, two to six pills.—ED.]

3. **GELATINE CAPSULES OF COPAIVA**; *Baccæ Copaiferæ factitiæ*, Pharm. Castrensis Ruthenica.—(Prepared by dipping the bulbous extremity of a metallic rod into a concentrated solution of gelatine. When the rod is withdrawn it is to be rotated in order to diffuse the gelatine equally over the bulb. As soon as the gelatinous film has hardened, it is to be removed from the bulb and placed on pins furnished with heads, and fixed on a cork table. When dried, the capsules are placed in little cells in the cork table; the balsam is introduced into them by means of a glass tube, and they are then closed by dropping some concentrated solution of gelatine on the orifices.[1]) Desfontenelle[2] has described another method of making the capsules. Gelatine capsules are the invention of a Frenchman of the name of Mothe: they have been introduced with the view of avoiding the nauseous odour and taste of various medicines (as balsam or oil of copaiva, oil of cubebs, creasote, Dippel's oil, &c.) When swallowed, the gelatinous capsule dissolves in the gastro-intestinal juices, and the liquid medicine escapes. The capsules found in the shops are olive-

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[1] For further details, consult Sir James Wylie's *Pharmacopœia Castrensis Ruthenica*, p. 681, Petropoli, 1840.

[2] *Journ. de Chim. Méd.* vi. 103, 2d sér.; and *Lancet*, March 7, 1840.

shaped, and contain about ten grains of balsam. Ratier[1] has proposed to introduce them into the rectum. For this purpose they are to be conveniently greased.

ORDER LXV. TEREBINTHACEÆ, *Jussieu.*—THE TEREBINTH TRIBE.

BURSERACEÆ, XANTHOXYLACEÆ, CANNARACEÆ, AMYRIDACEÆ, and ANACARDIACEÆ, *Lindley.*

CHARACTERS.—*Flowers* hermaphrodite, polygamous, or diœcious. *Sepals* 3 to 5, more or less united at the base, imbricated in æstivation, very rarely adherent to the ovary. *Petals* rarely 0, generally distinct, as many as, and alternate with, the sepals, very seldom united at the base; imbricated in æstivation. *Stamens*, as well as the petals, arising from the lower part of the calyx, or from the calycine disk, rarely from the torus surrounding the ovary; either equal in number to, and alternate with, the petals, or double (very rarely quadruple) the number of the petals, and then placed alternately before and between the petals. *Carpels*, in some, numerous, distinct, with one style,—in others, many, united by the ovaries; in either case some of them are frequently abortive, and hence the carpels in many appear solitary, 1-celled, but the number of the styles and stigmas then usually indicate abortion. *Fruit* capsular or drupaceous. *Seeds* few, usually solitary, commonly exalbuminous. *Embryo* straight, curved, arched, or folded back; *cotyledons* various; *radicle* usually superior (De Cand.)

PROPERTIES.—The principles common to all the Terebinthaceæ are: 1st, *Fixed oil* in the seeds; 2ndly, *Volatile oil combined with resin* in the turpentine of the pistacias; 3rdly, *Resin* which flows either naturally or from artificial openings in the stems of many of the species; 4thly, *Gum usually combined with resin*—as in olibanum, myrrh, tamahaca, &c.[2]

295. PISTACIA TEREBINTHUS, *Linn. L. E. D.*—THE TURPENTINE PISTACIA.

Sex. Syst. Diœcia Pentandria.

(Oleo-resina, *L.*—Liquid resinous exudation, *E.*)

HISTORY.—This tree is the Τέρμινθος or Τερέβινθος of the Greeks. Hippocrates employed the fruits, the buds, and the resin, medicinally.

BOTANY. **Gen. Char.**—*Flowers*, diœcious, apetalous. *Males: Racemes* amentaceous, with 1-flowered scales [bracts]. *Calyx* 5-cleft. *Stamens* 5; *anthers* almost sessile, 4-cornered. *Females: Racemes* more lax. *Calyx* 3- or 4-cleft. *Ovary* 1- to 3-celled. *Stigmas* 3, rather thick. *Drupe* dry, ovate, with a somewhat osseous nut, usually 1-celled, 1-seeded, sometimes bearing two abortive cells at the side. *Seeds* solitary in the cells, affixed to the side of the cell, exalbuminous. *Cotyledons* thick, fleshy, oily, with a superior lateral radicle.—*Trees* with pinnate leaves (De Cand.)

Sp. Char.—*Leaves* pinnate, with an odd one; *leaflets* about 7, ovate-lanceolate, rounded at the base, acute, mucronate (De Cand.)

A *tree* of 30 or 35 feet in height. Young *leaves* reddish, old ones dark-green. *Racemes* compound. *Fruit* almost round, purplish.

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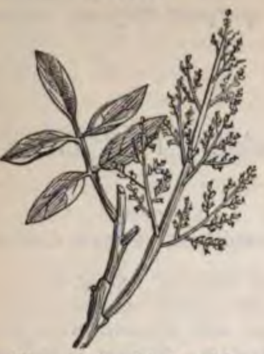
[1] *Dict. Prat. de Méd.* xv. 288.

[2] Fée, *Cours d'Hist. Nat.* i. 619.

FIG. 69.



Pistacia Terebinthus (the female plant).

Hab.—Syria and the Greek Archipelago.

EXTRACTION.—Tournefort[1] says, that the turpentine harvest in Scio is made, from the end of July to October, by cutting crosswise with a hatchet the trunks of the largest turpentine trees. The turpentine runs down on flat stones placed under the trees, where it hardens. The quantity yielded by each tree is small, not exceeding eight or ten ounces.

PROPERTIES.—Chian or Cyprus turpentine (*Terebinthina Chia* seu *Cypria*) has the general properties of the coniferous turpentines already described. Its consistency is that of honey, but more glutinous. Its colour is greenish-yellow. It has an agreeable turpentine-like odour, combined with the odour of fennel, or, according to some, of citron and jasmine. Its taste is very mild. By keeping, it resinifies, and acquires a somewhat less agreeable odour. Genuine Chian turpentine is scarce; the coniferous turpentines being usually sold for it.

COMPOSITION.—I am unacquainted with any analysis of it; but its composition is doubtless similar to the coniferous turpentines.

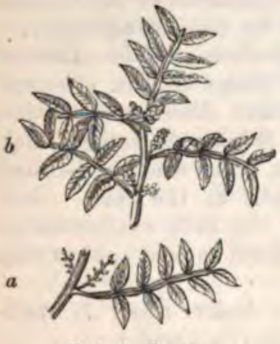
PHYSIOLOGICAL EFFECTS, USES, AND ADMINISTRATION.—Exactly similar to the other coniferous turpentines.

296. PISTACIA LENTISCUS, *Linn. L. E. D.*—THE MASTIC OR LENTISK TREE.

Sex. Syst. Diœcia Pentandria.

(Resina ex inciso cortice fusa, *L.*—Concrete resinous exudation, *E. D.*)

FIG. 70.



Pistacia Lentiscus.
a. The male plant.
b. The female plant.

HISTORY.—This tree is the Σχῖνος of the Greeks. Hippocrates employed the leaves, resin (*mastic*), and the oil prepared from the fruit, in medicine.

BOTANY. **Gen. Char.**—See *Pistacia Terebinthus.*

Sp. Char.—*Leaves* abruptly pinnate; *leaflets* about 8, lanceolate. *Petiole* winged (De Cand.)

A mere *bush.* *Leaves* evergreen. *Flowers* very small. In *var.* β *angustifolia* the leaflets are somewhat linear: in *var.* γ *Chia* they are ovate.

Hab.—South of Europe, North of Africa, Levant.

EXTRACTION.—Tournefort[2] says, that in Scio the extraction of mastic commences on the first of August. The bark is cut crosswise with huge knives. The mastic exudes and hardens partly on the stem, partly on the ground. The same incisions furnish mastic towards the end of September, but in lesser quantities. The mastic which concretes on the stem is called *mastic in the tear,* while that which falls to the earth constitutes *common mastic.*

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[1] *Voyage into the Levant.* ii. 62, Lond. 1741.
[2] *Ibid.* ii. 60, Lond. 1741.

PROPERTIES.—Mastic (*mastiche*) occurs in small spherical, flattened, or irregular, pale-yellow tears, which are externally farinaceous, owing to their mutual attrition. Their fracture is vitreous. They have a mild, agreeable odour, and an aromatic taste.

COMPOSITION.—Mastic consists of a minute portion of *volatile oil,* about 90 per cent. of *resin* soluble in alcohol, and 10 per cent. of a resinous substance (*masticine*) insoluble in alcohol.

1. SOLUBLE ACID MASTIC RESIN; *Resin, α.*; *Mastichic Acid.*—This resin is soluble in alcohol. It possesses the properties of an acid, and combines with bases to form four series of salts. Its formula, according to Johnstone, is $C^{40}H^{31}O^{4}$.

2. INSOLUBLE NON-ACID MASTIC RESIN; *Resin, β.*; *Masticine.*—This resin is insoluble in alcohol. It is white, elastic, tenacious, soluble in an alcoholic solution of *resin α,* as well as in ether and oil of turpentine. Its formula, according to Johnstone, is $C^{40}H^{31}O^{2}$. To this resin mastic owes its toughness.

PHYSIOLOGICAL EFFECTS.—Analogous to common resin and the turpentines.

USES.—Mastic is rarely employed as a medicine. It has been used to check excessive discharges from the mucous membranes, as leucorrhœa, gleet, chronic pulmonary catarrh, and old diarrhœas. Dentists occasionally employ it for filling up the cavities of carious teeth. The Turkish ladies chew it to sweeten the breath, and preserve the teeth and gums. Dissolved in alchohol it forms a very useful cement and varnish. A solution of it in oil of turpentine is a common varnish.

ADMINISTRATION.—It is exhibited as an adjunct only to other medicines. It is a constituent of the *dinner pills* (composed of aloes, ʒvj.; mastic and red roses, āāʒij.; syrup of wormwood, q. s.), in which it serves to divide the particles of the aloes. It is a constituent of the *tinctura ammoniæ composita,* Ph. L.; formerly called *eau de luce* or *spiritus ammoniæ succinatus,* which has been already described.

297. RHUS TOXICODENDRON, *Linn.*—TRAILING POISON OAK, OR SUMACH.

Sex. Syst. Pentandria Trigynia.

HISTORY.—The attention of the medical practitioners of this country was first drawn to the medical properties of this plant in 1793, by Dr. Alderson, of Hull.[1] It was first described by Cornutus, in his *Plant. Canad. Hist.* Paris, 1635.[2]

BOTANY. **Gen. Char.**—*Calyx* small, 5-partite, persistent. *Petals* 5, ovate, spreading. *Stamens* 5, all fertile in the male and hermaphrodite flowers. *Ovary* 1, somewhat globose, 1-celled. *Styles* short, 3, or *stigmas* 3 sessile. *Drupe* almost juiceless, 1-celled; nut bony, perhaps by abortion 1-seeded, and sometimes 2- or 3-seeded. *Seed* exalbuminous, invested by the funiculus arising from the base of the nut; *cotyledons* foliaceous; *radicle* incumbent on the upper edge of the cotyledons (De Cand.)

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[1] *Essay on Rhus Toxicodendron,* 3d edit. 1804.

[2] Busse, *Diss. Inaug. de Rhoe Toxicod.* p. 10, Berol. 1811.

Sp. Char. — *Leaves* pinnate with an odd leaflet, trifoliate; *leaflets* angularly incised, pubescent (De Cand.)

Shrub, 1 to 3 feet high. *Stems* many, branching, covered with a brown bark. *Flowers* greenish-white. *Fruit* a round drupe, about as large as a pea. — *Juice* acrid, milky, becoming black by exposure to the air, and forming an indelible ink when applied to cotton or linen.

Rhus Toxicodendron is considered by some botanists as a variety only of *Rhus radicans*. I have followed Nuttall and De Candolle in considering it a distinct species.

Hab.—United States of America.

COMPOSITION. — I am not acquainted with any detailed analysis of this plant. There are at least two substances in it worthy of investigation: — viz., *a volatile, acrid (narcotico-acrid?) principle*, and *the substance which blackens by exposure to the air*. *Tannic* and *gallic acids* are said to be constituents of it.

PHYSIOLOGICAL EFFECTS. **1. Of the Emanations.** — When not exposed to the sun's rays, as when it grows in shady places, and during the night, this plant evolves a hydrocarburetted gas, mixed with an acrid vapour, which acts most powerfully on certain individuals exposed to its influence, and produces violent itching, redness, and erysipelatous swelling of the face, hands, or other parts which have been subjected to its operation; these effects are followed by vesications, and desquamation of the cuticle. In some cases the swelling of the face has been so great as to have almost obliterated the features; but all persons are not equally susceptible of this poisonous operation; so that some peculiar condition of the cutaneous organ seems necessary for the effect to be produced.[1]

2. Of the Plant. *a. On Animals.* — Orfila made several experiments with the watery extract of the *Rhus radicans* (whose operation is probably quite similar to that of *R. Toxicodendron*), and concludes that "internally administered, or applied to the cellular texture, it produces a local irritation, followed by an inflammation more or less intense, and that it exerts a stupefying action on the nervous system after being absorbed." Lavina gave a few drops of the milky juice of Rhus Toxicodendron to guinea-pigs and birds, which were at first stupefied by it, but gradually recovered without any other noxious effect.

β. On Man.—In the human subject *small doses* of the leaves increase the secretions of the skin and kidneys, act slightly on the bowels, and, in paralysed persons, are said to have produced a return of sensibility and of mobility, with a feeling of burning and pricking, with twitchings, in the paralysed parts. *Large doses* occasion pain in the stomach, nausea, vomiting, giddiness, stupefaction, and an inflammatory swelling of the paralysed parts. These effects show that the poison oak possesses the two-fold operation of an acrid and a narcotic.

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[1] Orfila, *Toxicol. Gén.*

USES.—It has been employed in old paralytic cases depending on a torpid condition of the nerves. It has also been given in chronic rheumatism, obstinate eruptive disorders, in some cases of amaurosis, and other nervous affections of the eyes.

ADMINISTRATION.—The *powder* of the leaves is given in doses of from half a grain to a grain, gradually increased until some obvious effect is produced.

[It has been excluded from the Materia Medica in the last editions of the London and Dublin Pharmacopœias.—ED.]

298. BOSWELLIA THURIFERA, *Colebrooke.*—THE OLIBANUM TREE.

Boswellia serrata of former Pharmacopœias.

Sex. Syst. Decandria Monogynia.

HISTORY.—Olibanum was the frankincense used by the ancients in their religious ceremonies. It is the *Lebonah* of the Hebrews, the *Lubán* of the Arabs; from either of which terms the Greeks, probably, derived their names for it, *Λίβανος, Λιβανωτὸς*.[1] The earliest notice of it is by Moses.[2] Dioscorides[3] calls it *Λίβανος*.

BOTANY. **Gen. Char.**—*Flowers* bisexual. *Calyx* small, 5-toothed, persistent. *Petals* 5, obovate-oblong, very patent, acute at the base, inserted under the margin of the disk; æstivation very slightly imbricative. *Stamens* 10, inserted under the disk, alternately shorter; *filaments* subulate, persistent; *anthers* caducous. *Torus* a cup-shaped disk, fleshy, larger than the calyx, crenulated on the margin. *Ovary* oblong, sessile; *style* 1, the length of the stamens, caducous; *stigma* capitate, 3-lobed, *Fruit* capsular, 3-angled, 3-celled, 3-valved, septicidal; valves hard. *Seeds* solitary in each cell, surrounded by a broad membranaceous wing. *Cotyledons* intricately folded, multifid.—*Trees* producing balsam and resin. *Leaves* deciduous, alternate towards the top of the branches, unequally pinnated; *leaflets* opposite, serrated. *Stipules* 0. *Racemes* terminal or axillary. *Flowers* on short pedicels, white (Wight and Arnott).

Sp. Char.—*Leaflets* oblong, obtuse, serrated, pubescent. *Racemes* axillary, single, shorter than the leaves (Wight and Arnott).

Hab.—[Considered to be the produce of Arabia, although the plant is said to be found growing in India on the mountainous parts of Coromandel.—ED.]

DESCRIPTION.—*Olibanum*, *Indian Olibanum*, or *Olibanum of the Boswellia serrata* (*gummi-resina Olibanum; gummi Olibanum; Olibanum indicum* seu *ostindicum*) is imported from India in chests. It consists of round, oblong, or ovate pale-yellowish, semi-opaque, fragile tears, having a balsamic resinous odour.

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[1] Colebrooke, *Asiat. Research.* ix. 377.

[2] *Exodus*, xxx. 34.

[3] Lib. i. cap. 81.

Mr. Johnstone states that it is a mixture of at least two gum-resins: —

1. *One variety* of gum-resin consists of opaque, dull, hard, and brittle pieces, which, when introduced into alcohol, become almost immediately white and opaque, from a white powdery coating or crust left on their surface as the soluble portion is taken up. This variety constitutes the larger portion of the olibanum of commerce, and is the more fragrant when burned. It contains an acid resin and a volatile oil.

2. The *second variety* is in clearer, yellower, less brittle, and opaque pieces, generally in long tears (stalactitic ?) as they have flowed from the tree. When introduced into alcohol, they become clear and transparent. They contain less gum. Their resin resembles colophony.

On the above statement I may remark, that all the tears of olibanum which I have tried became opaque when immersed in alcohol.

The substance called on the continent AFRICAN or ARABIAN OLIBANUM (*Olibanum arabicum*) is rarely met with in this country. It consists of smaller tears than those of the Indian variety. They are yellowish or reddish, and intermixed with crystals of carbonate of lime. Some have supposed it to be the produce of *Juniperus*—some of an *Amyris*,—others of *Boswellia glabra*, which Roxburgh says yields a substance used as an incense and a pitch in India.

[COMMERCE.—Strictly speaking, there does not appear to be any Indian variety of this gum; but like acacia and myrrh, it reaches Bombay from the Persian Gulf; and owing to its being thence exported to Europe, the statement has arisen that there is an Indian distinct from the Arabian variety. It is probable, as the author states, that the plant producing olibanum may grow on the Coromandel Coast; but as there are never any importations from Madras or Calcutta, it is clear that it is not an Indian product. Like gum acacia, olibanum is assorted at Bombay, and is there packed in cases of from two to four hundredweight each, the cases and the marks of both articles being generally the same. From Africa the importations have nearly ceased. They used to consist of small tears, much mixed with small pieces of stone. The importations from Bombay amounted, on the average of ten years, 1835 to 1844, to 1417 chests per annum, of about 4 cwts each (?), of which less than the tenth part was kept for home consumption, the bulk being re-exported to the continent for use in the religious ceremonies of the Roman and Greek churches. On the average of the years 1851-4, the annual importation of olibanum into London amounted to 4179 chests—being 16,719 chests in the four years.—ED.]

COMPOSITION.—Olibanum (Indian?) was analysed by Braconnot,[1] who found the constituents to be as follows:—*volatile oil* 8, *resin* 56, *gum* 30, *matter like gum, insoluble in water and alcohol* 5·2; loss 0·8.

1. VOLATILE OIL.—By distillation with water, olibanum yielded Stenhouse[2] colourless volatile oil, similar to oil of turpentine, but smelling more agreeably. Its formula is $C^{35}H^{28}O$, which is identical with that for oil of spearmint.

2. RESIN.—According to Johnston,[3] olibanum contains two kinds of resin.

a. Acid Resin.—This is found in the rounded, opaque, dull, hard, and more brittle pieces, which become covered with a white crust. Its formula is $C^{40}H^{32}O^{6}$.

β. Resin resembling Colophony.—This is found in the clearer, yellower, less brittle and opaque long tears (stalactitic ?). Its formula is $C^{40}H^{22}O^{4}$.

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[1] *Ann. de Chim.* lxviii. 60.

[2] *Pharm. Central-Blatt für* 1840, p. 828.

[3] *Phil. Trans.* for 1839, p. 304-5.

PHYSIOLOGICAL EFFECTS.—Olibanum is regarded as a stimulant of the same kind as the resins or oleo-resins.

USES.—It is rarely employed internally. Formerly it was used to restrain excessive discharges from the mucous membranes. Thus it was given in chronic diarrhœa, old catarrhs, but more especially in leucorrhœa and gleet. It was also administered in affections of the chest; as hemoptysis. It has been used as an ingredient of stimulating plasters. As a fumigating agent it is employed to overpower unpleasant odours, and to destroy noxious vapours.

ADMINISTRATION.—Dose, ʒs. to ʒj., formed into an emulsion by the aid of the yolk of an egg.

299. BALSAMODENDRON MYRRHA, *Nees, L. E. D.*—THE MYRRH TREE.

Sex. Syst. Octandria Monogynia.

(Gummi-resina e cortice exudata, *L.*—Gummy-resinous exudation, *E. D.*)

HISTORY.—The earliest notice of myrrh occurs in the Old Testament,[1] from which it appears that this gum-resin was an object of trade with the Eastern nations more than 3,500 years ago. In the Hebrew language it is called *Mur*, in allusion to its bitterness. The Greeks, who were well acquainted with it, called it *Σμύρνα*; or, in the Æolic dialect, *Μύῤῥα*. Hippocrates[2] employed it in medicine in several diseases; and Dioscorides[3] describes several kinds of it, the most esteemed being the *Troglodytica.* Some of the ancient poets tell us that the name of this gum-resin was derived from Myrrha, the daughter of Cinyras, King of Cyprus, who fell in love with her own father, and after having had criminal intercourse with him, fled to Arabia, where she was changed into a tree which still bears her name.

Notwithstanding the early knowledge of, and acquaintance with, the uses of myrrh, we had no accurate account of the tree which yields it until the return of Ehrenberg from his travels with Hemprich, during 1820-25, in various parts of Africa and Asia. He brought with him a specimen of the tree, which has been described and figured by Nees von Esenbeck[4] under the name of Balsamodendron Myrrha. The first notice of the discovery of these travellers which I have met with, is in Alex. Humboldt's "*Bericht über die naturhistorichen Reisen der Herren Ehrenberg und Hemprich,*" &c. published at Berlin in 1826.

BOTANY. **Gen. Char.**—*Flowers* irregular. *Calyx* 4-toothed, persistent. *Petals* 4, linear-oblong; æstivation induplicate-valvate. *Stamens* 8, inserted under the annular disk; elevated warts between the stamens. *Ovary* 1. *Style* 1, short, obtuse. *Berry* or *drupe* ovate, acute, with four sutures, 1- to 2-celled; cells 1-seeded.—Oriental *trees* giving out balsam. *Leaves* pinnated; *leaflets* 3 to 5, sessile, without dots (De Cand.)

Sp. Char.—*Stem* shrubby, arborescent; branches squarrose, spinescent.

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[1] *Gen.* xxxvii. 25.

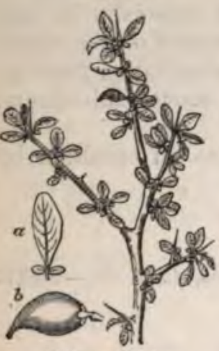
[2] See Dierbach, *Arzneim. des Hippok.* p. 224.

[3] Lib. i. cap. 77.

[4] *Beschr. Offic. Pflanz.*

Leaves ternate; *leaflets* obovate, obtuse, obtusely toothletted at the apex, the lateral smooth. *Fruit* acuminate (Nees).

FIG. 71.



Balsamodendron Myrrha.

a. A leaf. *b.* The fruit.

Bark pale ash-grey, approaching white. *Wood* yellowish white; both it and the bark have a peculiar odour. *Leaves* on short stalks. *Flowers* unknown. *Fruit* ovate, smooth, brown, somewhat larger than a pea; surrounded at the base by a four-toothed calyx, and supported on a very short stalk.

Hab.—Gison, on the borders of Arabia Felix.

This species is considered by Lindley[1] to be identical with the *Amyris Kataf* of Forskäl,[2] the *Balsamodendron Kataf*, Nees; *Protium Kataf*, Lindley. But the identity of the two plants is by no means satisfactorily demonstrated. *A. Kataf* is distinguished, 1st, by the absence of thorns; 2dly, by the leaves being four times larger, and the lateral leaflets agreeing both in form and size with the terminal ones; 3rdly, the fruit (according to Forskäl) is round, with a depressed umbilicus at the point.

EXUDATION OF MYRRH.—Myrrh, according to Ehrenberg, exudes, like cherry-tree gum, from the bark of the tree. It is at first soft, oily, and of a pale yellow colour; but, by drying, becomes darker and redder.

DESCRIPTION.—Myrrh (*gummi-resina myrrha; gummi-myrrha*) is imported from the East Indies in chests, each containing from 2 to 4 hundredweight. Formerly the finest kind was brought from Turkey (*Turkey myrrh*), and an inferior sort from the East Indies (*East India myrrh*); but at the present time nearly the whole is brought from India. In 1839, duty (6s. per cwt.) was paid on 216 cwt. Sometimes the same chest contains myrrh of all qualities, which is then termed *myrrh in sorts* (*myrrha naturalis* seu *myrrha in sortis*): but commonly it is brought over more or less sorted. [This article is invariably imported from Bombay in the same packages and by the same houses that import the so-named "East Indian" Gum Arabic and Olibanum. There is hardly a doubt that these three articles are the produce of Arabia, brought to Bombay in exchange for East Indian goods. The importations amounted to 82 chests per year, on the average of the ten years 1835—1844, and on the average of the four years 1851—1854, the importation of myrrh into London amounted to 243 chests per year. There is now no duty.—ED.]

PROPERTIES.—Myrrh is only partially soluble in water, alcohol, or ether: the first of those liquids takes up the gum principally, the two latter the resin and oil. Water takes up more of the myrrh than alcohol does. Alkaline solutions are good solvents for myrrh. A few drops of nitric acid dropped on a small fragment of myrrh, or on a concentrated tincture, develope a red colour.

1. **Myrrh of first quality**; *Turkey myrrh* (*Myrrha turcica; M. vera* seu *rubra* vel *pinguis*).—It occurs in pieces, of irregular forms and of

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[1] *Fl. Med.* 170.
[2] *Fl. Ægypt. Arab.* 80.

variable sizes, consisting of tears (either distinct or agglomerated), usually covered with a fine powder or dust. In a chest of this kind a few pieces of fine quality may sometimes be met with, nearly as large as a man's fist. The colour varies, being pale reddish-yellow, red, or reddish-brown. The pieces are fragile, semi-transparent, with a dull, in part splintery, fatty kind of fracture. In consequence of imperfect desiccation the largest and finest pieces often present internally, opaque, whitish or yellow striæ, or veins, which have been compared by Dioscorides, Pliny, and many others, to the white marks on the nails. The odour of myrrh is aromatic and balsamic, peculiar, but to most persons pleasant; the taste is bitter, acrid, and aromatic. The purest, palest, and most odorous pieces are sold as *picked myrrh* (*myrrha electa* seu *selecta*).

2. **Myrrh of second quality**; *Myrrh in distinct small tears or grains.*—Imported from the East Indies in chests. It consists of distinct tears or grains, which are rounded or irregular, and vary in size from that of a pin's head to a pepper-corn, none of them in my specimens being so large as a small pea. They are somewhat shiny, more or less transparent, and vary in colour from pale or whitish yellow to reddish brown. It consists of tears of myrrh intermixed with fragments of gum-arabic, and of some resin very like mastic, or juniper. Many druggists in this country regard it as merely the siftings of the finest kind; but I cannot agree with them in this opinion.

3. **Myrrh of third quality**; *East India Myrrh* (*Myrrha indica* seu *ostindica*). Formerly this was the only kind imported from the East Indies. It occurs in pieces, which are darker coloured than those of the so-called Turkey myrrh, and whose average size does not exceed that of a walnut. It is often mixed with other substances, particularly with *Indian Bdellium* (the produce of *Amyris Commiphora*), and with a substance of similar appearance to dark-red-coloured Senegal gum (*Opocalpasum?*)

COMPOSITION.—Myrrh was analysed, in 1816, by Pelletier,[1] and in 1819 by Braconnot[2] and by Brandes.[3]

		Brandes.	*Braconnot.*	*Pelletier.*
Volatile oil		2·60	2·5	34
Resin	soft	22·24	23·0	
	hard	5·56		
Gum	soluble (*Arabine?*)	54·38	46·0	66
	insoluble	9·32	12·0	
Salts (benzoates, malates, phosphates, sulphates, and acetates of potash and lime)		1·36	...	...
Impurities		1·60	...	...
Loss		2·94	16·5	...
		100·00	100·0	100

1. VOLATILE OIL.—Colourless, though by age it becomes yellowish. It is a thin fluid, heavier than water, having the odour and taste of myrrh, and being soluble in alcohol, ether, and the fixed oils. It partially evaporates in the air, the residue being a glutinous varnish-like substance. It readily distils over with water, but not with spirit. With sulphuric, nitric, and hydrochloric acids, it forms red solutions.

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[1] *Ann. de Chim.* lxxx. 45.

[2] *Ibid.* lxvii. 52.

[3] *Berl. Jahrb.* xxii. 275.

2. RESIN.—According to Brandes, this is of two kinds, both of which are soluble in alcohol.

α. Soft resin.—Odorous, soft at ordinary temperatures, and insoluble in ether. Unverdorben regards it as a mixture of hard resin and volatile oil.

β. Hard resin (*Myrrhic acid ?*).—Inodorous, hard, insoluble in ether, soluble in caustic alkalies, forming resinates (*myrrhates ?*). The resinate of baryta is soluble in water, but not in alcohol.

3. GUM.—Is also of two kinds: *α. Soluble* in water; the solution forming precipitates with alcohol and the salts of lead, silver, the protosalts of tin, and of mercury. *β. Insoluble* in water.

PHYSIOLOGICAL EFFECTS.—In *small* or *moderate doses*, myrrh promotes the appetite, creates an agreeable warmth in the stomach, and occasions slight constipation. Its continued employment in these quantities assists the assimilative functions, increases the muscular activity, gives greater firmness to the solids, and diminishes excessive secretion from the mucous membranes.

In *large doses* (as from half a drachm to a drachm) it excites a disagreeable sensation of heat in the stomach, and in irritable conditions of this viscus may even bring on a slight inflammatory state; it accelerates the frequency and increases the fulness of the pulse, gives rise to a febrile condition of the body, and creates a feeling of warmth in the mucous membrane (especially in the membrane lining the air-passages). It has been supposed to have a specific stimulant operation on the uterus, and has, in consequence, been termed emmenagogue; but it does not appear to have any title to this appellation.

The local operation of myrrh is that of a mild astringent and a moderate stimulant. Kraus[1] says it is very similar to that of cinchona. In its remote effects myrrh partakes of both the tonic and stimulant characters, and hence some have denominated it a *tonico-stimulant;* and as its stimulant powers are analogous to those of the balsams, it has also been called a *tonico-balsamic.*

Myrrh differs from the fetid gum-resins (assafœtida, galbanum, &c.) in not possessing that influence over the nervous system which has led to the use of the latter in various spasmodic diseases, and to their denomination of antispasmodics. From the balsamic substances it is distinguished by its tonic influence. It has some relation to cascarilla, but is more stimulant.

USES.—The employment of myrrh is indicated in diseases characterised by feebleness of the vascular action, by weakness of the muscular fibre, and by excessive secretion from the mucous membrane. Relaxed and leucophlegmatic constitutions best admit of its use. It is frequently associated with tonics, especially the chalybeates, or with aloes. Indeed, it is rarely used alone. It is contraindicated in inflammatory diseases, and in plethoric individuals. It is used in the following cases:—

1. *In disordered conditions of the digestive organs* arising from or connected with an atonic condition of the alimentary canal, as in some forms of dyspepsia, apepsia, flatulence, &c.

2. *In disordered states of the menstrual functions* characterised by a

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[1] *Heilmittellehre.*

lax and debilitated state of the system, as in many cases of amenorrhœa and chlorosis.

3. *In excessive secretion from the mucous membranes* unconnected with inflammatory symptoms, and accompanied by marks of debility. In chronic pulmonary catarrh, for example, it is sometimes admissible and useful. It has also been used to check puriform expectoration in phthisis pulmonalis, though it is now rarely employed for this purpose, and in most cases it proves either useless or injurious. In mucous discharges from the urino-genital organs, as well as from the alimentary canal, it has also been administered.

4. *As an external application*, myrrh is employed for various purposes. Thus it is used as a *dentifrice*, either alone or mixed with other substances; and in caries of the teeth, and in a spongy or ulcerated condition of the gums, is very serviceable. As a *gargle* in ulcerations of the throat, tincture of myrrh, diluted with water, is frequently employed. In *foul ulcers*, myrrh has been used to destroy unpleasant odour, to promote granulations, and to improve the quality and diminish the quantity of the secreted matters: for these purposes it has been applied in a pulverulent form, as an ointment, or as a wash.

ADMINISTRATION. — Dose, gr. x. to ʒss. It is given in the form of powder, pill, or emulsion. The aqueous infusion and extract, which have been recommended for their mildness, are seldom employed, and very rightly so, as I conceive. Myrrh is a constituent of several pharmacopœial preparations; as *Mistura ferri composita*, *Pilulæ ferri compositæ*, *Pilulæ aloës cum myrrhâ*, *Decoctum aloës compositum*, *Pilulæ rhei compositæ*, and *Pilulæ galbani compositæ* (see these preparations.)

TINCTURA MYRRHÆ, L. E. D. (Myrrh, powdered, ℥iij.; Rectified Spirit, Oij. Macerate for seven days, then press out and strain, *L.* — The *Edinburgh College* orders three ounces and a half of Myrrh, in moderately fine powder, to the same quantity of Spirit. "Pack the myrrh very gently, without any spirit, in a percolator; then pour on the spirit; and when thirty-three fluidounces have passed through, agitate well, to dissolve the oleo-resinous matter which first passes, and which lies at the bottom. This tincture is much less conveniently obtained by the process of digestion for seven days," *E.*)—The *Dublin College* directs four ounces of Myrrh in coarse powder to two pints of Spirit. The maceration to continue for fourteen days, and the liquid to be then strained.)— Tonic and stimulant. Seldom employed internally, and then usually as an adjunct.—Dose, ʒss. to ʒj. It is applied as a stimulant to foul and indolent ulcers. Diluted with water (which renders it slightly milky by the separation of the resin, without any precipitate being formed), it is used as a wash for the mouth in ulceration and sponginess of the gums, and as a gargle in affections of the throat.

OTHER MEDICINAL TEREBINTHACEÆ.

1. ELEMI. — The history and origin of *Elemi* are involved in great obscurity. It appears that the resinous products of various terebinthaceous trees have been described

under this name. The Edinburgh College correctly, as I conceive, declare elemi to be the "*concrete resinous exudation from one or more unascertained plants.*" The London and Dublin Colleges formerly called it the resin of *Amiris elemifera* of Linnæus.[1] But this distinguished botanist has confounded, under one name, two distinct plants; viz. *Icica Icicariba*, De Candolle (*Icicariba*, Pison), a Brazilian tree (yielding, according to Pison, a resin similar to the so-called *gum elemi*), and *Amyris Plumieri*, De Candolle, a native of the Antilles, which also yields a resin. The London College, in their Pharmacopœia, no longer speak of elemi as the product of an Amyris, but describe it as a concrete turpentine derived from an unknown plant. To assist in determining the origin of elemi, I have taken much pains to ascertain its commercial route; and I find that all the importations of it, which I can trace, were (formerly) from Amsterdam or Hamburgh. Pomet also states, that true elemi was brought from Holland; whence I conclude that it is the produce of a Dutch settlement. But one of the importers expressed to me his belief (in which I do not coincide), that the elemi brought from Holland was spurious, being made of common frankincense. It would appear that formerly it came from Ethiopia by way of the Levant. [For some time past all the importations have taken place directly from the East.—ED.] It is possible that it may be the produce of the *Canarium Zepyrinum sive sylvestre primum Canari Barat* of Rumphius,[2] which he says yields a resin so like elemi that it may be taken for it, and he puts a query, whether this tree may not be the source of it. I have received from Dr. Christison a specimen of the resin of *Canarium balsamiferum* of Ceylon, which in odour and general appearance strongly resembles elemi. I have met with three kinds of elemi:—1st. *Elemi in flag leaves; Résine elemi en pains*, Guibourt; *Resina elemi orientalis*, Martius. This is imported from Holland in triangular masses, weighing from one to two pounds each, enveloped in a palm-leaf. It agrees in most of its properties with the next variety. Martius ascribes it to *Amyris zeylanica* (*Balsamodendron zeylanicum*, Kunth). But if this were correct, it would doubtless be imported direct from Ceylon to England, which it is not.—2nd. *Elemi in the lump*. This differs from the following kind only in its much paler yellow colour.—3rd. *Brazilian elemi; Résine élémi du Brésil*, Guibourt. This variety I received from Prof. Guibourt. If it be really brought from the Brazils, it is doubtless obtained from *Icica Icicariba* (De Candolle) by incisions into the stem, and is gathered twenty-four hours afterwards. "It is imported in cases containing two or three hundred pounds each. It is soft and unctuous, but becomes hard and brittle by cold and age. It is semi-transparent, of a yellowish white colour, mixed with greenish points; its odour is strong, agreeable, analogous to that of fennel. This is owing to a volatile oil, which may be obtained from it by distillation. As it owes its properties to this oil, it should be selected recent, not too dry, and strongly odorous" (Guibourt). It is soluble in alcohol, with the exception of its impurities, and a white, opaque, insipid, inodorous, crystallisable substance, called *elemine*, which is soluble in boiling alcohol. Martius describes *African Elemi* (the genuine elemi of the ancients) as being in small pieces like scammony, and having an acrid taste.

[The description most extensively dealt in is that which is brought to this country from Singapore in a soft, strong-smelling mass, in cases of about 2 cwt. It is the produce of Manilla, and we are credibly informed that it is not imported from any part west of Singapore. In addition to this, the Brazil sort is occasionally seen in the market.—ED.]

Bonastre analysed elemi, and found its constituents to be, *volatile oil* 12·5, *resin soluble in both hot and cold alcohol* 60·0, *resin soluble in hot but not in cold alcohol* (*elemine*) 24·0, *bitter extractive* 2·0, impurities 1·5. The resin α (readily soluble in cold alcohol) consists, according to Johnston, of $C^{40}H^{32}O^{4}$; while the resin β (sparingly soluble in cold alcohol) is composed of $C^{40}H^{33}O$.

The physiological effects of elemi are similar to those of the terebinthinates. It is, however, never employed internally. Its principal or sole use is as a constituent of the *Unguentum Elemi*, L.D., which is composed, according to the *London College*, of Elemi, ℥iij.; Common Turpentine, ℥iiss.; Suet, ℥vj.; Olive Oil, ℥ss. The Elemi and Suet are melted together and then removed from the fire, and the turpentine and oil immediately added; the mixture is then expressed through linen. The *Dublin College* employs

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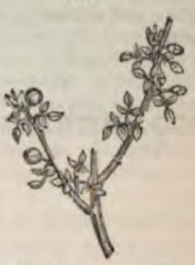
[1] See his *Mat. Med.*

[2] *Herb. Amb.* lib. iii. cap. ii. p. 153.

℥iv. of Elemi; and lb. j. of White Wax Ointment.—Elemi ointment is stimulative and digestive. It is applied as a stimulant to old and indolent ulcers, and to promote the discharge from issues and setons. It is an imitation of the ointment recommended by Arcæus, in 1574.[1]

2. **Balm of Gilead** (*Balsamum gileadense; B. de Mecca; Opobalsamum; Balm* of the Old Testament; Βάλσαμον of Theophrastus and Dioscorides) is procured from *Balsamodendron gileadense*, a middling-sized tree growing in Arabia. Mr. Bruce says it is obtained by cutting the bark of the tree with an axe, and receiving the juice in a small earthen bottle. The quantity obtained in this way is, however, very small; and none of it, it is said, reaches this country, that which occasionally comes here being obtained by boiling the branches and leaves in water. It is a whitish, turbid, thick, very odorous liquid, which resinifies, and becomes yellow by keeping. Trommsdorff[2] analysed it, and found it to consist of *volatile oil* 30·0, *soft resin insoluble in alcohol* 4·0, *hard resin soluble in alcohol* 64·0, *extractive* 0·4, loss 1·6. Bonastre[3] also analysed it. Its physiological effects are believed to be similar to balsam of copaiva and the liquid turpentines. The most wonderful properties were formerly ascribed to it. It is rarely or never employed by Europeans, but it is adapted to the same cases as the terebinthinates. The Asiatics use it for its odoriferous as well as its medicinal qualities.

Fig. 73.



Balsamodendron gileadense.

3. The term **Bdellium** is applied to two gummy-resinous substances. One of these is *Indian Bdellium* or *false myrrh* (the *Bdellium* of Scripture), which is obtained from *Amyris* (*Balsamodendron?*) *Commiphora*. Dr. Roxburgh[4] says that the trunk of this tree is covered with a light-coloured pellicle, as in the common birch, which peels off from time to time, exposing to view a smooth green coat, which in succession supplies other similar exfoliations. This tree diffuses a grateful fragrance, like that of the finest myrrh, to a considerable distance around. Dr. Royle[5] was informed that this species yielded bdellium; and in confirmation of his statement I may add, that many of the pieces of this bdellium in my museum have a yellow pellicle adhering to them precisely like that procured from the common birch, and some of the pieces are perforated by spiny branches—another character serving to recognise the origin of this bdellium. Indian bdellium has considerable resemblance to myrrh. Many of the pieces have hairs (of the goat?) adhering to them. The other kind of bdellium is called *African Bdellium*, and is obtained from *Heudolatia africana*.[6] It is a native of Senegal, and is called by the natives, who make toothpicks of its spines, *Niottout*. It consists of rounded or oval tears, from one to two inches in diameter, of a dull and waxy fracture. By age they become opaque, and covered, externally, by a white or yellowish dust. It has a feeble but peculiar odour, and a bitter taste. Pelletier[7] found it to consist of *resin* 59·0, *soluble gum* 9·2, *bassorin* 30·6, *volatile oil and loss* 1·2. Resin of bdellium [African bdellium?] consists, according to Johnston, of $C^{40}H^{31}O^{5}$.

ORDER LXVI. RHAMNACEÆ, *Lindley*.—THE BUCKTHORN TRIBE.

RHAMNI, *Jussieu*.—RHAMNEÆ, *De Candolle*.

Characters.— Tube of the *calyx* adherent to the ovary, lobes valvate in æstivation, definite in number, 4 or 5. *Petals* as many as (rarely none), and alternate with, the lobes of the calyx; often squamiform with a concave limb. *Stamens*, as many as the petals, and opposite to them; *anthers* 2-celled. *Ovary* either adnate to the whole of the calyx, or adherent at the lower part or middle, 2 or 4-celled; cells with 1 ovule each. *Style* 1; *stigmas* 2 to 4. *Pericarp* usually indehiscent, baccate, drupaceous or samröideous, rarely capsular. *Seeds* erect, destitute of aril; *albumen* none, or usually fleshy; *embryo* straight in the axis of the seed, with an inferior *radicle*, and somewhat foliaceous *cotyledons*.—*Shrubs* or *trees*. *Leaves* simple, alternate, rarely opposite, often with stipules. *Flowers* small, often greenish (De Cand.)

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[1] *De recta curand. vulner. ratione*, Amst. 1658.

[2] Thomson, *Org. Chem.* 523.

[3] *Journ. de Pharm.* xviii. 95.

[4] *Fl. Ind.* ii. 245.

[5] *Illustr.* 176.

[6] Richard and Guillemin, *Fl. de Sénégambie.*

[7] *Ann. de Chim.* lxxx. 39.

PROPERTIES.—Require further examination. The fruit of Rhamnus contains purgative and colouring matters: that of Zyzyphus is acidulous, saccharine, and alimentary.

300. RHAMNUS CATHARTICUS, *Linn. L. E.*—COMMON BUCKTHORN.

Sex. Syst. Pentandria Monogynia.

(Fructûs succus, *L.*—Fruit, *E.*)

HISTORY.—According to Dr. Sibthorp,[1] the *ῥαμνος* of Dioscorides is *Lycium europæum*. The earliest notice of Rhamnus catharticus is in Tragus.[2]

BOTANY. **Gen. Char.**—*Calyx* 4- to 5-cleft, often circumcissile in the middle after flowering; the base persistent under, and adherent with, the fruit. *Petals* alternate with the lobes of the calyx, or none. *Stamens* inserted opposite the petals. *Style* 2- to 4-cleft. *Fruit* almost juiceless, or baccate, 2- to 4-celled; *cells* in the juiceless fruit, separable, 1-seeded (rarely 2-seeded), dehiscing inwards by a longitudinal chink. *Seeds* oblong, marked at the external side by a deep groove, which is broader towards the base (De Cand.)

Sp. Char.—Erect. *Leaves* ovate, toothed. *Flowers* fascicled, polygamous-diœcious. *Berries* 4-seeded, somewhat globose (De Cand.)

A spreading *shrub* with terminal *spines*. *Leaves* with 4 or 6 strong lateral nerves parallel with the margin or rib. *Stipules* linear. *Flowers* yellowish green: the *males* with broader *petals*, 4 *stamens* and 1 short *style*, without either ovary or stigma; the *females* smaller, with 4 *stigmas* projecting beyond the calyx, and rudimentary stamens. *Fruit* black, 4-celled.

Hab.—Indigenous; in hedges, groves, and thickets.—Flowers in May. The fruit is ripe in September.

COMPOSITION.—The expressed juice of buckthorn berries has been examined, chemically, by Vogel,[3] and by Hubert.[4]

Vogel's Analysis.	*Hubert's Analysis.*
Peculiar colouring matter.	Green colouring matter.
Acetic acid.	Acetic and malic acids.
Mucilage.	Brown gummy matter.
Sugar.	Sugar.
Nitrogenous matter.	Bitter substance (*cathartine?*).
Buckthorn Juice.	Buckthorn Juice.

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[1] *Prodr. Fl. Græcæ*, i. 155.

[2] See Sprengel, *Hist. Rei Herb.* ii. Præf. xi.

[3] *Bull. de Pharm.* iv. 64.

[4] *Journ. de Chim. Méd.* vi. 193.

1. PURGATIVE PRINCIPLE.—The nature of the purgative principle of buckthorn requires further elucidation. Hubert asserts that it possesses the properties of cathartine before described (see *Senna*); but his experiments are not conclusive. As from 25 to 30 berries are sufficient to purge, while an ounce of the juice is required to produce the same effect, it is probable that the greater part of the purgative principle resides in the marc left after the expression of the juice. [Winckler[1] has examined the substance called rhamicine, which Fleury obtained from the unripe berries: he considers that as the berries ripen, this principle becomes changed into cathartine and grape sugar.—ED.]

2. COLOURING MATTER.—It is soluble in water, less so in alcohol, and insoluble in ether and oils. Acids redden it; whereas alkalies render it green. Vogel thinks its proper colour is green, and that it only becomes purple by the action of the acetic acid, which is developed in the ripe fruit. When the juice is evaporated to dryness with lime, it constitutes *sap-green*, or the *vert de vessie* of the French.

3. MUCILAGE.—The mucilage of buckthorn is of a peculiar nature. It disappears by fermentation. It is abundant in the recent juice, to which it gives consistence.

PHYSIOLOGICAL EFFECTS.—The berries, as well as their expressed juice, are powerful hydragogue cathartics; usually griping and causing great thirst, and sometimes operating with considerable violence. "Syrup of buckthorn," says Sydenham,[2] "purges in a manner only water, and evacuates a great quantity of it, and does not disturb the blood, nor render the urine high-coloured, as other purges usually do: and this syrup has but one ill property—viz. that whilst it is working, it makes the sick very thirsty. But if you give the greatest dose of it to those that are difficultly purged, it will not give many stools, nor bring away so much water from them as it ought."

USES.—Buckthorn berries were formerly employed as cathartics, but their violent operation, and the sickness, griping, and thirst occasioned by them, have led to their disuse. "They be not meete to be ministered," says Deodoens,[3] "but to young and lustie people of the countrie, which doe set more store of their money than their lives." The syrup is the only preparation now in use.

ADMINISTRATION.—Dose of the *recent berries*, ℈j.; of the *dried* ones, ʒj.; of the *expressed juice*, f℥ss. to f℥j.

SYRUPUS RHAMNI, L. E.; *Syrup of Buckthorn.* (Fresh Juice of Buckthorn Berries, Oiv.; Ginger sliced, Allspice bruised, of each, ʒvj.; Sugar, lb. vj.; Rectified Spirit, ℥vj. Set by the juice for three days, that the dregs may subside, and strain. To a pint of the clear juice add the Ginger and Allspice; then macerate for four hours with a gentle heat, and strain; boil down the residue to a pint and a half; mix the liquors; add the sugar, and dissolve; lastly, mix in the spirit).—Cathartic. It is employed as an adjunct to purgative and occasionally to diuretic mixtures. Sydenham found it, in one case, most beneficial in dropsy; and "with the juvenile confidence of an inexperienced man, verily believed," as he tells us, that he "had got a medicine that would cure any manner of dropsy;" but he found his "mistake in a few weeks."—Dose, ℥ss. to ℥j.

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[1] *Jahrb. für prakt. Pharm.* Oct. 1849.

[2] *Works*, by Dr. Pechey, p. 391, 4th edit.

[3] *New Herbal*, by Lyte, p. 501, Lond. 1619.

ORDER LXVII. SIMARUBACEÆ, *Lindley*.—THE QUASSIA TRIBE.

SIMARUBEÆ, *Richard*.

CHARACTERS.—*Flowers* hermaphrodite, or rarely by abortion unisexual. *Calyx* 4- or 5-partite, persistent. *Petals* 4 or 5, hypogynous, erect, deciduous. *Stamens* equal in number, or twice as many as, the petals, inserted on an hypogynous disk, free. *Ovary* with lobes as numerous as the petals; *style* 1, filiform, enlarged at the base. *Carpels* as many as the petals, articulated on the axis, capsular, bivalved, dehiscing inwardly, monospermous. *Seeds* exalbuminous, pendulous; *cotyledons* 2, thick; *radicle* short, superior.—*Trees* or *shrubs*, with a very bitter bark and milky juice. *Leaves* alternate, pinnate, without stipules (De Cand.)

PROPERTIES.—Bitterness is the prevailing quality of the order (see *Quassia*).

301. SIMARUBA AMARA, *Aublet, E. D.*—BITTER SIMARUBA, OR MOUNTAIN DAMSON.

Simaruba officinalis, *De Cand.*—Quassia simaruba, *Linn.*
Sex. Syst. Decandria Monogynia.
(Root, *E.*—Cortex radicis, *D.*)

HISTORY.—Simaruba bark was first known to Europeans in 1713, when some of it was sent to Paris from Guiana, as the bark of a tree called by the natives *Simarouba*, which they employed with great success in dysentery. The first authentic botanical account of the tree was given by Dr. Wright.[1]

BOTANY. **Gen. Char.**—*Flowers* unisexual. *Calyx* small, cup-shaped, 5-toothed, or parted. *Petals* 5, longer, spreading. *Males:* stamens nearly equal to the petals, arranged around a receptacle bearing at its apex 5 very minute lobes (rudiments of ovaries), or sometimes none. *Females; ovaries* 5, placed on an even disk, surrounded at the base by 10 short hairy scales (rudiments of stamens). *Styles* the same number, short, distinct at the base; there united into 1, crowned by a broader 5-lobed stigma. *Fruit* 5 drupes (Lindley).

Sp. Char.—Male *flowers* decandrous. *Stigma* 5-partite. *Leaves* abruptly pinnate; *leaflets* alternate, somewhat stalked, pubescent beneath (De Cand.)

A very tall *tree*. *Roots* long and creeping. *Stem* thick; *bark* bitter, internally white, fibrous, and tough, externally blackish and furrowed in the old trees, but smooth and grey, with yellow spots, in the young ones. *Leaves* alternate; *leaflets* alternate, 2 to 9 on each side, oval, firm, mucronate. *Flowers* small, yellowish white, some male, others female, mixed, in panicles. *Fruit* of 5 ovate, black, smooth capsules, placed on a fleshy disk.

Hab.—Guiana, Cayenne, Jamaica.

DESCRIPTION.—The simaruba bark (*cortex simarubæ*) of the shops is the bark of the root (*cortex radicis simarubæ*), and is brought from Jamaica in bales. It is odourless, but bitter, and occurs in broad, folded, very fibrous pieces, several feet long, which are externally rough, warty, and marked with transverse ridges. The epidermis is of a greyish or whitish yellow colour: beneath it the bark is darker, and yellowish brown. On the inner surface the bark is pale yellowish white.

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[1] *Trans. Royal Soc. of Edinb.* vol. ii. part 2, p. 73.

COMPOSITION.—Simaruba bark was analysed by Morin,[1] who found in it the following substances:—*Quassite, a brittle resin, an aromatic volatile oil having the odour of benzoin, woody fibre, almin, an ammoniacal salt, mulic acid*, traces of *gallic acid, malate* and *oxalate of lime, oxide of iron*, and *silica*. No notice is taken of the *mucilage*, which, according to Pfaff,[2] constitutes nearly one-fourth part of the bark.

PHYSIOLOGICAL EFFECTS.—In small doses simaruba acts like the simple bitter tonics, whose effects have been already described. In full doses, however, it causes vomiting and purging, and is said also to promote perspiration and urine. Dr. Wright states, that negroes are less affected by it than whites.

Desbois de Rochefort[3] classed it among emetics; and Bichat proposed it as a substitute for ipecacuanha. It is, however, usually arranged with the tonics.

USES.—Simaruba may be employed in the same cases as other vegetable bitters. It has been principally celebrated in *dysentery* (whence the Germans called it *Ruhrrinde*, or *dysentery-bark*) by Dr. Wright[4] and others. It is, of course, only applicable in the latter stages of the acute and the asthenic and chronic forms of the disease. More recently, Dr. O'Brien[5] has borne testimony to its good effects, when given in conjunction with opium, in epidemic dysentery. It has also been employed in the advanced stages of *diarrhœa*. Like other vegetable tonics, it may be administered in *dyspepsia, anorexia*, and *intermittents*. It is a remedy, however, which is seldom used.

INFUSUM SIMARUBÆ, E. D.; *Infusion of Simaruba Bark*. (Simaruba bark, bruised, ʒiij. [ʒij. *D.*]; Boiling Water, Oj. [f℥ix. *D.*] Macerate for two hours in a lightly covered vessel, and strain [through linen or calico, *E.*]—Tonic; in large doses emetic.—Dose, as a tonic, f℥j. to f℥ij.

302. PICRÆNA (*Quassia*) EXCELSA, *Lindley, L. E. D.*—THE LOFTY BITTER-WOOD TREE.

Quassia excelsa, *Swartz*.—Picræna amara, *Wright*.—Quassia polygama, *Lindsay*.
Sex. Syst. Decandria Monogynia.
(Lignum, *L. D.*—The Wood, *E.*)

HISTORY.—The wood of this tree has been introduced as a substitute for that of Quassia amara, with which it has often been confounded.

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[1] *Journ. de Pharm.* viii. 57.

[2] *Syst. de Mat. Méd.* ii. 74.

[3] *Cours Elément. de Mat. Méd.* i. 357.

[4] *Account of Quassia Simaruba.*

[5] *Trans. of the King and Queen's College of Physicians*, v. 237, Dublin.

BOTANY. **Gen. Char.**—*Flowers* polygamous. *Sepals* 5, minute. *Petals* 5, longer than the sepals. *Stamens* 5, about as long as the petals, rather shaggy; *anthers* roundish. *Ovaries* 3, seated on a round, tumid receptacle. *Style* 3-cornered, bifid; *stigmas* simple, spreading. *Fruit* 3, globose, 1-celled, bivalved drupes, which are distant from each other, and placed on a broad hemispherical receptacle (Lindley).

Sp. Char. — The only species.

A tall, beautiful timber *tree*, sometimes 100 feet high. *Leaves* pinnate, with an odd one; *leaflets* 4 to 8 pairs, opposite, stalked, oblong, acuminate, unequal at the base. *Racemes* towards the ends of the branchlets, axillary, very compound. *Flowers* small, pale yellowish green. *Drupe* size of a pea, black, shining, round.[1]

Hab. — Jamaica.

DESCRIPTION. — Quassia wood (*lignum quassiæ*),—sometimes called Jamaica quassia wood (*lignum quassiæ jamaicensis*) in order to distinguish it from the wood of Quassia amara,—is imported from Jamaica in billets of various sizes (sometimes a foot in diameter, and several feet in length), and covered externally with a smooth brittle bark. The wood is white, but by exposure to the air becomes yellowish; it has no odour, but a most intensely bitter taste. Floors made of quassia wood retain for many years their bitterness. An efflorescence of nitrate of potash is frequently observed on it.[2]

ADULTERATION. — Quassia wood has recently been somewhat scarce, and, in consequence, its chips have been adulterated with the chips of other woods; but the intense bitterness of the genuine wood readily distinguishes it.

COMPOSITION. — Though quassia wood has been the subject of repeated chemical investigation, I am unacquainted with any complete analysis of it. But from the experiments of Pfaff[3] and others, the following appear to me to be the principal constituents of it: — *volatile oil* a minute trace, *a bitter principle* (quassite), *gummy extractive*, *pectin*, *woody fibre*, and *various salts* (as oxalate, tartrate, and sulphate of lime, chlorides of calcium and sodium, an ammoniacal salt, and nitrate of potash).

QUASSITE; *Bitter Principle of Quassia; Quassin.* — Obtained by adding lime water to a concentrated aqueous decoction of quassia (to separate the pectin and other substances), evaporating and treating the residue with alcohol, which takes up the quassite, a brown colouring matter, and some salts. By repeated solution and evaporation in alcohol, with a little ether, the quassite is obtained pure. Quassite occurs in small, white, prismatic crystals, which are fusible, odourless, intensely bitter, readily soluble in alcohol, but very slightly so in water or ether. Its solubility in water is increased by several salts and vegetable principles. Its watery solution is precipitated (white) by tannin, but not by iodine, chlorine, corrosive sublimate, salts of iron, acetate, or diacetate of lead. It is a neutral body, though soluble in sulphuric and nitric acids. It consists of *carbon* 66·912, *hydrogen* 6·827, and *oxygen* 26·261; or $C^{10}H^{6}O^{3}$.[4]

PHYSIOLOGICAL EFFECTS. *a. On Animals.*—From recent experiments it appears that quassia wood acts on animals as a narcotic poison. Dr. Wright[1] tells us that no insect will live near cabinet work made of it. It has been long known that an aqueous infusion of this substance was an excellent fly-poison; but Hartl, one of Buchner's pupils, has lately shown that it also possesses poisonous properties with respect to the larger animals.[2] Thus he found that a rabbit, into a wound of whose thigh a grain of the alcoholic extract of quassia had been introduced, lost his strength and liveliness, and died on the third day. A second experiment made on an older and stronger animal was attended with the same results. No pain appeared to be experienced, nor were there any marks of irritation or inflammation observable after death. Kurtz[4] mentions that complete paralysis of the hind extremities of a dog affected with the mange (*Fetträude*) was brought on by washing the ulcers with decoction of quassia: in seven hours, however, it disappeared.

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[1] Lindsay, *Trans. Roy. Soc. Edin.* iii. 205.

[2] Planche, *Journ. de Pharm.* xxiii. 542.

[3] *Syst. d. Mat. Med.* ii. 21.

[4] Wiggers, *Ann. d. Pharm.* xxi. 40; *Brit. Ann. of Med.* for 1837, p. 561.

These experiments seem to show that the bitter principle of quassia possesses poisonous properties somewhat like those of the *Amer* of Welther.

β. On Man. — In the usual medicinal doses, quassia operates as a stomachic and tonic—that is, it is bitter to the taste, promotes the appetite, and assists the digestive functions. It is devoid of all irritant, stimulant, and astringent properties; and has been, therefore, sometimes taken as a type of the simple or pure bitters. It is more powerful than, but in other respects analogous to, gentian in its operation. "We can find nothing in the wood," says Dr. Cullen,[4] "but a pure and simple bitter;" — and he goes on to observe that he believes it to be an excellent substance, capable of doing all that any pure and simple bitter can do, but no more.

Does it act as a narcotic on man, as on other animals? I have employed, and seen others administer quassia most extensively, but never had grounds for suspecting any effect of the kind alluded to. Yet some have observed effects which certainly seem to favour the notion that quassia possesses a specific influence over the cerebro-spinal system. In females endowed with extreme susceptibility, I have seen, says Barbier,[5] involuntary movements of the arms and legs produced by the aqueous infusion of quassia. Kraus[6] says that the continued use of quassia brings on amblyopia (dimness of sight); and Kurtz asserts that the long-continued use of quassia has brought on amaurosis.

Like many other substances, quassia mixed with dead animal matter checks putrefaction; and hence it is termed antiseptic. Ebeling,[7] many years ago, performed some experiments to determine its power in this respect, compared with other bitters, and found it much superior to several of them.

Uses.—Quassia is employed in the same cases as several other simple bitters, some of which have been already noticed. Though I am not disposed to place much confidence in the above-quoted statements of Barbier, Kraus, and Kurtz, yet a cautious practitioner would avoid employing it in amaurosis and cerebral affections. Quassia is principally employed in *dyspepsia*, *anorexia*, and other stomach disorders of a functional kind of an atonic character, more especially when occurring in a gouty subject. Though it has been beneficially employed in *intermittents*, few practitioners will, I suspect, use it, when they can procure cinchona, quina, or arsenic.

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[1] *Med. Plants of Jamaica.*
[2] Buchner, *Toxicol.* S. 266.
[3] G. A. Richter, *Ausf. Arzneimittell.* Supp. Bd. S. 42, 1832.
[4] *Mat. Med.*
[5] *Traité Elém. de Mat. Méd.* 2de édit. i. 250.
[6] *Heilmittell.* S. 412, 1831.
[7] Schlegel, *Thes. Mat. Med.* t. ii.

Kraus suggests that it may be useful in intolerance of light, and other diseases of the eye, accompanied with great sensibility without fever or congestion; yet only (he adds) as an adjuvant to hyoscyamus and belladonna.

An infusion of quassia has been proposed as a wash in compound fractures, wounds, and ulcers, to keep off insects. In its use, however, we should bear in mind the effect which Kurtz states was produced on a dog by a wash of this kind.

1. **INFUSUM QUASSIÆ**, L. E. D.; *Infusion of Quassia*. (Quassia wood, in chips, ℈ij. [ʒj. *E. D.*]; Boiling [distilled, *L.*] Water, Oj. [f℥viiss. *D.*] Macerate for two hours in a lightly covered vessel, and strain [through linen or calico, *E.*] [Infuse one hour, *D.*])—Tonic. Generally employed in dyspeptic and other stomach affections. It has an advantage over some other vegetable bitter infusions, that chalybeates can be combined with it without changing its colour.—Dose, f℥j. to f℥iij. It is in common use as a fly-poison.

2. **TINCTURA QUASSIÆ**, E.; *Tincture of Quassia*. (Quassia in chips, ʒx.; Proof Spirit, Oij. Digest for seven days, and filter.)—Dose, fʒss. to fʒij. This tincture possesses all the bitterness of the wood.

3. **TINCTURA QUASSIÆ COMPOSITA**, E.; *Compound Tincture of Quassia*. (Cardamom seeds bruised, Cochineal bruised, of each ℥ss.; Cinnamon, in moderately fine powder; Quassia in chips, of each ʒvj.; Raisins, ℥vij.; Proof Spirit, Oij. Digest for seven days, strain the liquor, express strongly the residuum, and filter. This tincture may also be obtained by percolation, as directed for the Compound Tincture of Cardamom, provided the quassia be rasped or in powder.)—An aromatic tonic.—Dose, fʒj. to fʒij.

OTHER MEDICINAL SIMARUBACEÆ.

The wood of Quassia amara (Linn. E.) has been employed in medicine under the name of Surinam quassia wood (*lignum quassiæ surinamense*). Fermin mentions that about the year 1714 the flowers of this shrub were highly valued at Surinam on account of their stomachic properties. In 1730, the root is said to have been found in the collection of Seba, a celebrated spice-dealer of Amsterdam. Haller tells us that a relative of his took quassia for an epidemic fever in 1742, and that it was then a well-known medicine. In 1763 Linnæus published a dissertation on this medicine, in which he states that he received specimens of the tree from one of his pupils, C. D. Dahlbergh, a military officer and counsellor at Surinam, who had become acquainted with the medical properties of the root through a black slave named Quassia, who employed it as a secret remedy in the cure of endemic malignant fevers of that place. From this circumstance Linnæus named the tree in honour of the slave, *Quassia*. Rolander, who returned from Surinam in 1756, tells us he saw and conversed with this black, who was almost worshipped by some, and suspected of magic by others. Rolander found him to be a simple man, better skilled in old women's tales than in magic.[1] All parts of the plant are intensely bitter. The wood, as I have received it, is in cylindrical pieces (covered by a thin, greyish-white, and bitter bark) not exceeding two inches in diameter, very light, without odour, but having an extremely bitter taste. The chemical and medical properties are similar to the wood of *Simaruba amara*.

ORDER LXVIII. RUTACEÆ, *De Candolle*.—THE RUE TRIBE.

CHARACTERS.—*Sepals* 3, 4, or 5; more or less adherent at the base, so that the calyx is dentate, cleft, or partite. *Petals* very rarely 6, usually as many as the sepals, frequently unguiculate, distinct. *Disk* fleshy-glandular, surrounding the ovary, arising from the receptacle external to the petals, and bearing the stamens on the upper part. *Stamens* usually twice as many as the petals, and then either all fertile or the alternate ones barren. *Carpels* as many as the sepals, sometimes fewer by abortion, either distinct or united at the base, or perfectly connate. *Style* arising from the centre of the ovary, single, divided into as many stigmas as there are ovaries. *Carpels*, when ripe, generally distinct, one-celled, dehiscent, bivalved, cocculose within. *Seeds* affixed to the inner angle, inverse; *embryo* straight, compressed; *radicle* superior.—*Herbs* or *shrubs*, with opposite or alternate stipulate leaves (Condensed from De Candolle).

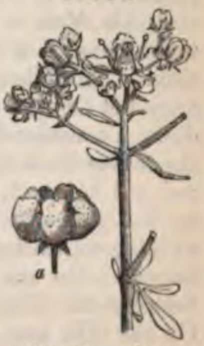
PROPERTIES.—Volatile oil and bitter matter are the predominating constituents of this order. These confer stimulant, tonic, and in some cases, narcotic qualities.

303. RUTA GRAVEOLENS, *Linn. L. E.*—COMMON OR GARDEN RUE.

Sex. Syst. Decandria Monogynia.
(Folium, *L.*—Leaves and unripe fruit, *E.*)

HISTORY.—This plant was highly esteemed by the ancients; and is frequently mentioned by Hippocrates under the name of *Πήγανον*. Pliny[2] says that Pythagoras (who died in the year 489 before Christ) fancied that rue was hurtful to the eyes; but, adds Pliny, he was in error, since engravers and painters eat it with bread or cresses to benefit their eyes. The ancients had a curious idea that stolen rue flourished the best; just as, says Pliny, it is said that stolen bees thrive the worst.

FIG. 74.



Ruta Graveolens.
a. Its capsule.

BOTANY. **Gen. Char.**—*Calyx* persistent, 4-, rarely 3- to 5-partite. *Petals* as many as the segments of the calyx, unguiculate, somewhat cochleate. *Stamens* twice as many as the petals. *Nectariferous pores* at the base of the ovary, as many as the stamina. *Ovary* on a short, thick stalk. *Style* 1. *Capsule* somewhat globose, divided into as many cells as there are petals. *Seeds* affixed by the internal angle;

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[1] Murray, *App. Med.* iii. 433.
[2] *Hist. Nat.* lib. xx. cap. 51, ed. Valp.

albumen fleshy; *embryo* curved; *radicle* long; *cotyledons* linear.—Perennial or suffruticose, fetid *herbs*, of a sea-green colour. *Leaves* alternate. *Flowers* corymbose, yellow, central, often 5-cleft (De Cand.)

Sp. Char.—*Leaves* supradecompound; lobes oblong, the terminal one obovate. *Petals* entire or somewhat toothed (De Cand.)

A small, branching, hairless *undershrub*, with the lower part only of the stem woody. *Leaves* dotted (the spots well seen when viewed by transmitted light) glaucous or bluish green. *Flowers* in umbellate racemes. *Petals* 4 or 5, unguiculate, concave, yellow. The first flower has usually ten stamens, the others eight. It is remarkable that the anthers move in turns to the pistillum, and, after having shed their pollen, retire. *Fruit* roundish, warted, 4-lobed, each lobe opening into two valves.

Hab.—South of Europe. Commonly cultivated in gardens.

Description.—The herb (*herba rutæ; herba rutæ hortensis*) is readily recognised by its strong disagreeable odour, which it owes to a volatile oil. Its taste is bitter and nauseous. 100 lbs. yield by drying about 22 lbs. The dried herb is greyish green, and has a less powerful odour. The *unripe fruit* (*fructus immaturus rutæ*) is also officinal in the Edinburgh Pharmacopœia.

Collection.—Rue was analysed, in 1811, by Mähl,[1] who found in it the following constituents:—*Volatile oil, bitter extractive, chlorophylle, peculiar vegeto-animal matter* precipitable by tincture of nutgalls, *malic acid, gum, albumen, starch,* and *woody fibre.*

1. Volatile Oil (See *post*).
2. Bitter Extractive.—Very bitter, insoluble in alcohol and ether.

Physiological Effects. α. *On Animals generally.*—Orfila[2] found that eighteen grains of oil of rue, injected into the veins of a dog, acted as a narcotic, and caused staggering and feebleness of the posterior extremities; but in a few hours the animal had recovered. Six ounces of the juice of rue, introduced into the stomach of a dog, killed it within twenty-four hours. The mucous membrane of the stomach was found inflamed.

β. *On Man.*—The topical action of rue is that of an acrid. When much handled it is apt to cause redness, swelling, and vesication of the skin. The following is an illustrative case from Buchner:[3]—After some very hot days in June 1823, Roth, an apothecary at Aschaffenburg, cut down a considerable quantity of rue while in full bloom, and separated the leaves from the stalks. The next morning both his hands were very red and hot, and, on the third day, appeared as if they had been exposed to hot aqueous vapour. They were besmeared with oil. Towards evening vesication commenced, and was most copious at the points of the fingers. On the fourth day the parts were still much swollen; and between the blisters, the skin had assumed a dark red or purplish hue. On the fifth and sixth days the swelling extended up the back part of the arms as far as the elbow. Poultices (of chamomile and elder flowers) were applied, and the blisters cut. Within four weeks the skin had gradually peeled off. His children, who had played with the rue, suffered from swelling of the face and hands.

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[1] Pfaff, *Mat. Med.* iv. 339.

[2] *Toxicol. Gén.*

[3] *Toxikologie*, 265.

The constitutional effects of rue are those of a stimulant and narcotic. It has long been celebrated as an antispasmodic in epilepsy, hysteria, and flatulent colic. It is a very popular emmenagogue, especially in hysterical cases; and is sometimes resorted to for the purpose of procuring abortion. Its narcotic and reputed uterine influence seems to be proved by three cases of poisoning with it, taken for the purpose of causing miscarriage, published by Helie.[1] In these cases the rue produced the effects of an acro-narcotic poison: viz. epigastric pain, violent and continued vomiting, inflammation and swelling of the tongue, salivation, colic, fever, thirst, disorder of the muscular system (manifested by tottering gait, and irregular and convulsive movements of the body and limbs), giddiness, confused vision, contracted pupil, delirium, or rather reverie, somnolency, and, after some days, miscarriage. During the stupor the pulse was feeble, very small, and slow (in one case beating only thirty times in the minute); there were great debility, faintness, and coldness of the skin. The general appearance was that of an intoxicated person. The ill effects lasted several days. In one case a decoction of fresh sliced roots, as big as the finger, had been taken; in the second, a decoction of the leaves; in the third, a large dose of the expressed juice of the fresh leaves.

USES.—Rue is comparatively but little employed by the medical practitioner. It formerly enjoyed great celebrity as an antispasmodic and emmenagogue; a celebrity which it still retains among the public. The observations above made on the effects of rue, prove that it is a much more active agent than is commonly supposed, and its remedial powers deserve to be more carefully examined than they have hitherto been. *In flatulent colic*, especially of children, it is an exceedingly valuable remedy, and may be administered either by the stomach, or, in infants, by the rectum, in the form of clyster. It may also be employed with benefit in some cases of *infantile convulsions*. It has been employed in *hysteria*, *amenorrhœa*, and *epilepsy*. In the two first of these maladies it will probably at times prove serviceable, and in them it deserves further trials. It has likewise been used as an *anthelmintic*. In former times it was eaten as a *condiment*, and was regarded as a universal *antidote* to poisons. It has been employed topically as an *antiseptic* in gangrene and foul ulcers, and likewise as a *local stimulant*, *rubefacient*, and *discutient*, in cold swellings and contusions.

ADMINISTRATION.—Dose of the *powdered leaves* from ℈j. to ʒss.; but this is not an eligible mode of preparation, as rue loses part of its activity (by the volatilisation of its essential oil) by drying. An *infusion* (prepared by digesting an ounce of the fresh herb in Oj. of boiling water), called *rue tea*, is a popular remedy. It is given in doses of f℥j. to f℥ij. *Rue water* (*aqua rutæ*) may be prepared with the oil, as *mint water*: its dose is f℥j. to f℥ij.

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[1] *Lond. Med. Gaz.* xxiv. 171.

1. CONFECTIO RUTÆ, L.; *Confection of Rue.* (Fresh Rue, Caraway, Bay Berries, of each, ℥iss.; Sagapenum, powdered, ℥ss.; Black Pepper, ʒij.; Prepared Honey, ℥xvj.; Distilled Water, as much as may be sufficient. Rub the dry ingredients into a very fine powder; then add the powder by degrees to the sagapenum, melted in the honey and water by a slow fire.)—Carminative and antispasmodic. Employed in flatulent colic and infantile convulsions. Objectionable in inflammation of the intestinal mucous membrane. Dose, ℈j. to ʒj. Sometimes employed in the maladies of children in the form of enema, composed of gruel and a scruple of the confection.

2. OLEUM RUTÆ, E.; *Oil of Rue.* (Obtained by submitting the herb, with water, to distillation.)—From 12 lbs., of the leaves, gathered before the plant had flowered, Lewis[1] obtained only about ʒiij. of oil; but the same quantity of herb, with the seeds almost ripe, yielded above ℥j. It is pale yellow, has a bitterish acrid taste, and a sp. gr. of 0·911. It is somewhat more soluble in water than the other volatile oils. It is stimulant, antispasmodic, and emmenagogue. Used in spasmodic and convulsive diseases, and in amenorrhœa.—Dose, gtt. ij. to vj. rubbed down with sugar and water.

3. SYRUPUS RUTÆ; *Syrup of Rue.*—Though syrup of rue is not contained in any of the British pharmacopœias, it is a useful preparation, and is always kept in the shops. It is usually prepared extemporaneously by adding eight or ten drops of the oil to a pint of simple syrup. It is used by nurses to relieve the flatulent colic of children.—Dose, one or two teaspoonfuls.

304. BAROSMA, *Willdenow.*—VARIOUS SPECIES, *L. E.*

Barosma serratifolia; B. crenulata, *Willd.*—Barosma crenata, *De Cand. Willd. Eckl. D.*
Sex. Syst. Pentandria Monogynia.
(Folium, *L.*—Leaves, *E.*—Folia, *D.*)

HISTORY.—The natives of the Cape of Good Hope employ several species of Barosma, on account of their odoriferous and medicinal properties. The Hottentots employ a powder, composed of the leaves of various odoriferous plants (principally Barosmas), under the name of *Bookoo* or *Buku*, for anointing their bodies.[2] Barosma crenata was introduced into the botanical gardens of this country in 1774, but it was not employed in medicine till 1823.

BOTANY. **Gen. Char.**—*Calyx* 5-cleft or parted; dotted. *Disk* lining the bottom of the calyx generally with a short, scarcely prominent, rim. *Petals* 5, with short claws. *Filaments* 10; the five opposite the petals sterile, petaloid, sessile, ciliated, obscurely glandular at the apex; the other five longer, smooth or hispid, subulate, with the anthers usually furnished with a minute gland at the apex. *Style* as long as the petals. *Stigma* minute, 5-lobed; *ovaries* auriculate at the apex, usually glandular and tuberculated. *Fruit* composed of 5 cocci covered with glandular dots at the back (Lindley).—*Shrubs. Leaves* opposite, flat, smooth, dotted. *Flowers* stalked, axillary.

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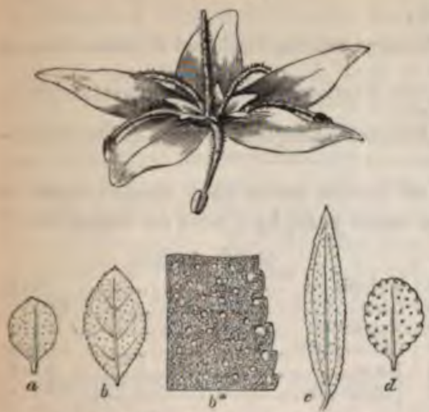
[1] *Mat. Med.*

[2] Burchell, *Travels in Southern Africa*, i. 479; and ii. 59.

FIG. 75.



Leaves of various species of Buchu.

a. Barosma graveolens; b. Diosma crenata; b*. a magnified view of a portion of it; c. D. serratifolia; d. B. venusta.

Species.—The leaves of several species of Barosma constitute *Buchu* or *Bucku.*

1. BAROSMA SERRATIFOLIA, Willd., De Candolle, Loddiges.—*Leaves* linear-lanceolate, serrulate, smooth, glandular. *Pedicels* solitary, bearing two leaflets above the middle (*De Cand.*) *Leaves* acuminate, 3-nerved. *Flowers* lateral, white.—Cape of Good Hope.

2. BAROSMA CRENULATA, Willd.; *Diosma crenulata*, Linn.; *D. odorata* (De Cand.); *D. latifolia*, Loddiges; *D. serratifolia*, Burchell.—*Leaves* ovate-oblong, crenate, smooth, glandular. *Pedicels* solitary, with two bracts immediately under the flower (De Cand.)—Upright *shrub*, between 2 and 3 feet in height; branches brownish-purple. *Leaves* about an inch long, oval-lanceolate, on very short petioles, very obtuse, delicately and minutely crenated, quite glabrous, rigid, darkish-green, and quite smooth above, with a very few obscure oblique nerves; beneath paler, dotted with glands which are scarcely pellucid, while at every crenature is a conspicuous pellucid gland; there is also a narrow pellucid margin round the whole leaf. *Peduncles* about as long as the leaf. *Calyx* of 5 ovate-acuminate leaflets, green, tinged with purple. *Corolla* of 5 ovate petals, purple in bud, bluish-coloured when fully expanded (Condensed from Hooker[1]).—Cape of Good Hope.

3. BAROSMA CRENATA, Ecklon and Zeyher;[2] *Diosma crenata*, De Candolle, Loddiges, L.D.—*Leaves* ovate [or obovate] acute, dotted, glandulose-serrate at the margin. *Pedicels* solitary, somewhat leafy (*De Cand.*)—*Flowers* pink, terminal, on short leafy branches.—Cape of Good Hope.

DESCRIPTION.—The leaves of several species of Barosma are known in the shops as *Bucku* (*Bucku*, E.; *Folia Barosmæ* seu *Diosmæ*). They are intermixed with stalks and fruit. They are smooth, somewhat shining, sharply or bluntly serrated or crenated, and beset both on the edges, especially between the teeth, and on the under surface, with glands filled with essential oil. Their consistence is coriaceous: their colour pale or yellowish-green; their odour strong and rue-like (though some compare it to rosemary, others to cumin, or cat's urine), and their taste is warm and mint-like. They present considerable variety in shape. The most common are the following: —

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[1] *Bot. Mag.* t. 3413.

[2] *Enum. Pl. Afr. austr.* i. 102, 1805.

a. Ovate or *obovate Buchu. Leaves of Barosma crenata*, Eckl. and Zeyher.—Leaves ovate, oval, oblong, or obovate.

b. Ovate-oblong Buchu. Leaves of Barosma crenulata, Willd.—Leaves ovate-oblong, or obovate-oblong, or oval-lanceolate, obtuse.

c. Linear-lanceolate Buchu. Leaves of Barosma serratifolia, Willd.—Leaves linear-lanceolate, acuminate.

COMPOSITION.—Two analyses of buchu have been made: one, in 1827, by Brandes[1]; the other, in the same year, by Cadet de Gassicourt.[2]

Brandes's Analysis.	
Pale yellow volatile oil	0·88
Resin	2·34
Bitter extractive (*Diosmin*)	3·78
Chlorophylle	4·77
Gum	12·71
Lignin	45·00
Brown substance extracted by potash	1·56
Nitrogenous matter extracted by potash	2·42
Albumen	0·58
Malic acid, and matter precipitable by tannin	1·56
Bassorin, with oxalate and phosphate of lime	4·53
Various salts of potash and lime	3·07
Water	12·94
Acetic acid and loss	3·86
Leaves of Diosma crenata	100·00

Cadet's Analysis.	
Volatile oil	0·665
Gum	21·170
Extractive	5·170
Chlorophylle	1·100
Resin	2·151
[Lignin, &c.	69·744]
Leaves of Diosma crenata	100·000

1. VOLATILE OIL OF BUCHU (*Oleum Barosmæ* seu *Diosmæ*).—Yellowish-brown, lighter than water; odour that of the leaves.

2. BITTER EXTRACTIVE; *Diosmin.*—Brownish-yellow, bitter, and somewhat pungent. Soluble in water; but neither in alcohol nor ether.

PHYSIOLOGICAL EFFECTS.—Buchu is an aromatic stimulant and tonic. Taken in moderate doses it promotes the appetite, relieves nausea and flatulence, and acts as a diuretic and diaphoretic. Its constitutional effects appear referable—first, to its action on the stomach; and, secondly, to the absorption of the volatile oil, which is subsequently thrown out of the system by the secreting organs, on which it appears to act topically in its passage through them. Buchu seems to have a specific influence over the urinary organs.

USES.—The natives of the Cape of Good Hope prepare a spirit of buchu (which they term *buchu brandy*), by distilling the leaves with the dregs of wine, which they employ in chronic diseases of the stomach and bladder. In this country buchu has been principally employed *in chronic maladies of the urino-genital organs.* Dr. Reece[3] first drew the attention of practitioners and the public to it in these cases; and in 1823, Dr. M'Dowell[4] gave a most favourable account of its good effects. It has since been employed by a considerable number of practitioners, and its remedial powers fairly tried. It seems to be principally adapted to chronic cases attended with copious secretion. *In chronic inflammation*

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[1] Gmelin, *Handb. d. Chem.* ii. 1258.

[2] *Journ. de Chim. Méd.* iii. 44.

[3] *Gazette of Health*, for 1821, 1822, 1823, and 1824.

[4] *Trans. of the King and Queen's College of Physicians*, iv. 131, Dublin, 1824.

of the mucous membrane of the bladder, attended with a copious discharge of mucus, it frequently checks the secretion, and diminishes the irritable condition of the bladder, thereby enabling the patient to retain his urine for a longer period; but I have several times seen it fail to give the least relief, and in some cases it appeared rather to add to the patient's sufferings. *In irritable conditions of the urethra*, as spasmodic stricture, and *in gleet*, it has occasionally proved serviceable. In *lithiasis*, attended with increased secretion of uric acid, it has been given with considerable benefit by Dr. Carter,[1] and others, and has appeared to check the formation of this acid. For the most part it should be given in these cases in combination with alkalies (as liquor potassæ). In *prostatic affections*, in *rheumatism*, and even in *skin diseases*, it has also been employed; and, it is said, with good effect. In *dyspepsia* Dr. Hulton has found it serviceable.[2]

ADMINISTRATION.—The dose of buchu, *in powder*, is ℈j. or ʒss. It is usually taken in wine. But the *infusion* and *tincture* are more eligible preparations.

1. **INFUSUM BUCHU**, L. D.; *Infusum Bucku*, E.; *Infusion of Buchu.* (Buchu, ℥j. [℥ss. *D.*]; Boiling [distilled, *L.*] Water, Oj. [Oss. *D.*] Macerate for four [two, *E.;* one hour, *D.*] hours in a lightly-covered vessel, and strain [through calico, *E.*])—Tonic, sudorific, and diuretic. —Dose, f℥j. to f℥ij.

2. **TINCTURA BUCHU**, D.; *Tinctura Bucku*, E.; *Tincture of Buchu.* (Buchu, ℥v.; Proof Spirit, Oij. Digest for seven days, pour off the clear liquor, and filter. This tincture may be conveniently and quickly made also by the process of percolation, *E.* — The proportions used by the *Dublin College* are essentially the same, and the tincture is directed to be prepared by maceration.)—Dose, fʒj. to fʒiv.

305. GALIPEA CUSPARIA, *De Candolle, L.* — CUSPARIA OR ANGUSTURA BARK.

Sex. Syst. Diandria Monogynia.

(Cortex, *L.* —Bark, *E.*)

HISTORY. — Mutis is said to have employed angustura bark in 1759; but it did not come to England until 1788, and was first publicly noticed in the *London Medical Journal* for 1789. Mr. A. E. Brande[3] says, that, in 1791, 40,000 lbs. or upwards had been imported. It was called *Cortex Angusturæ*, from Angostura, a place in South America, whence the Spaniards first brought it.

BOTANY. **Gen. Char.** — *Calyx* short, 5-toothed. *Petals* 5, united into a salver-shaped corolla, or closely approximating; tube short, pentagonal; lobes spreading, acute. *Stamens* 4 to 7, hypogynous, somewhat adherent to the petals, unequal, sometimes all fertile, commonly two

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[1] *Lond. Med. Rep.* April, 1826, p. 348.

[2] M'Dowell, *op. cit.*

[3] *Exp. and Observ. on the Angustura Bark*, Lond. 1793.

[illegible] *Styles* 5, [illegible] *stigmas. Car-* [illegible] *cotyledons* [illegible] — Leaves alternate, [illegible] *Panicles* axillary, [illegible]

[illegible] — [illegible] De Cand. [illegible] asserts that it is a [illegible] But it appears to me not [illegible] bark.

[illegible] Bonplandia trifoliata. Willd. [illegible] — *Leaves* trifoliate. *Racemes* [illegible] De Cand.) [illegible] feet long, grate- [illegible] leaflets sessile, un- [illegible] fascicles of hairs [illegible] *Stamens* monadelphous [illegible] according to Roemer — 4 ac- [illegible] with two short appendages. *Stigmas* 5. [illegible] — Forests of tropical America. Yields *Angustura bark* [illegible] and Bonpland.)

2. [illegible] Hancock. [illegible] — *Leaves* trifoliate. *Racemes* [illegible] *Stamens* 2. [illegible] sterile stamens?) [illegible] Hancock.) — A tree, usually 12 or 15 feet high, never exceeding 20 [illegible] when fresh having the odour of tobacco: leaflets oblong; [illegible] inches long, on very short [illegible] leaflets. *Flowers* white, hairy. *Stamens* [illegible] sterile ones [illegible] without appendages. [illegible] Seeds 2 in each capsule: 1 usually abortive. [illegible] Caroni, Alta Gracia, &c. Yields *Angustura or Cusparia bark*, Hancock.)

[illegible] — Angustura or Cusparia bark ([illegible] *angusturæ* seu [illegible]) is imported directly or indirectly from South America. "The [illegible] I have seen," says Mr. A. E. Brande, "has been put into [illegible] West Indies; but where the original package remains it is [illegible], and formed carefully of the large leaves of a species of palm, surrounded by a kind of network made of flexible sticks." It occurs in flat pieces and quills, of various sizes, the longest pieces being from six to ten inches in length, covered with a yellowish-grey or greyish-white spongy epidermis, easily scraped off by the nail. The internal surface is brownish, not quite smooth, somewhat fibrous or splintery, easily separable into laminæ; the fracture is short and resinous; the odour strong but peculiar, and somewhat animal; the taste bitter, aromatic, and slightly acrid.

SUBSTITUTION. I have already noticed the serious accidents which have resulted in consequence of the bark of the nux-vomica tree having

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[1] *Pl. Æquinoct.* ii. 59, t. 57.

[2] *Trans. Med.-Bot. Soc.* 1829, p. 16.

been substituted, either from ignorance or commercial cupidity, for angustura bark. Hence arose the distinction into *true* or *West India angustura*, and *false*, *spurious*, or *East India angustura*. Although the characters of the latter have been fully described, it may be as well to place them in contrast with those of the genuine angustura. In drawing up the following table of characteristics, I have been greatly assisted by the tables of Guibourt[1] and Fée.[2]

		Angustura Bark.	*Nux Vomica (False Angustura) Bark.*
Form		Quills or flat pieces, straight or slightly bent.	Quills or flat pieces, short, often very much twisted, like dried horn, arched backwards.
Odour		Disagreeable.	None, or very slight.
Taste		Bitter, afterwards somewhat acrid, persistent.	Intensely bitter, very persistent.
Hardness and Density		Bark fragile when dry, easily cut, light, tissue not very dense.	Broken or cut with difficulty, heavy, tissue compact.
Fracture		Dull and blackish.	Resinous.
Epidermoid Crust		Whitish or yellowish, insipid, unchanged or rendered slightly orange-red by nitric acid.	Variable: sometimes a spongy rust-coloured layer; at other times whitish, prominent spots, more or less scattered or approximated. Nitric acid makes it intensely dark-green or blackish.
Inner Surface		Separable into laminæ; deepened by nitric acid.	Not separable into laminæ; rendered blood red by nitric acid.
Infusion of the bark prepared by digesting one part of bark in 24 parts of water.	*Tinct. of Litmus.*	Blue colour destroyed.	Slightly reddened.
	Sesquichl. of Iron	Flocculent dark greyish-brown precipitate.	Clear yellowish-green liquor.
	Ferrocyanide of Potassium.	No change: hydrochloric acid caused a yellow precipitate.	Slight turbidness not augmented by hydrochloric acid; liquor greenish.
	Nitric Acid.	A small quantity makes the liquor cloudy; a large quantity renders it transparent deep red.	A small quantity makes the liquor clear and paler; a large quantity transparent red.

COMPOSITION.—Angustura has been the subject of repeated chemical investigation. Notices of the earlier attempts to analyse it are given by Meyer[3] and by Pfaff.[4] The analyses which deserve quoting are those of Pfaff[5] and Fischer.[6]

Pfaff's Analysis.

Volatile oil.
Bitter extractive.
Bitter resin.
Acrid oily resin.
Tartaric acid (free).
Salts (sulphate and tartrate of potash, chloride of potassium, and sulphate of lime).
Lignin.

Angustura bark.

Fischer's Analysis.

Volatile oil	0·3
Peculiar bitter principle	3·7
Bitter hard resin	1·7
Balsamic soft resin	1·9
Elastic resin	0·2
Gum	5·7
Lignin	89·1
Angustura bark	102·6

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[1] *Hist. des Drog.* 3me édit. ii. 6.
[2] *Cours d'Hist. Nat. Pharm.* i. 588.
[3] *Diss. Inaug. de Cort. Angust.*, Götting. 1790.
[4] *Syst. der Mat. Med.* ii. 58.
[5] *Ibid.*
[6] Gmelin, *Hand. d. Chem.* ii. 1258.

1. VOLATILE OIL; *Odorous Principle of Angustura.*—Obtained by submitting the bark to distillation with water. It is yellowish white, lighter than water, has the peculiar odour of the bark, and an acrid taste. To this, as well as to the resin, the bark owes its acrid, aromatic taste.[1]

2. ANGUSTURIN; *Cusparin*, Saladin; *Bitter extractive*, Pfaff; *Peculiar Bitter Principle.*—A neutral principle obtained by Saladin[2] in the form of tetrahedral crystals, by submitting the alcoholic tincture of the bark (prepared without heat) to spontaneous evaporation. When heated it fuses, loses 23·09 per cent. of its weight, and subsequently inflames, without giving any evidence of its being volatile or nitrogenous. It is insoluble in the volatile oils and in ether; but dissolves slightly in water, more so in alcohol. Alkaline solutions also dissolve it. Nitric acid renders it greenish yellow; sulphuric acid reddish brown. Tincture of nutgalls precipitates it from its aqueous and alcoholic solutions.

3. RESIN.—The *hard* resin is brown, bitter, soluble in potash, alcohol, and acetic ether; but insoluble in sulphuric ether and oil of turpentine. The *soft* resin is acrid, greenish yellow, soluble in alcohol, ether, oil of turpentine, and almond oil; but insoluble in a solution of potash. It is coloured red by nitric acid.[3]

PHYSIOLOGICAL EFFECTS.—A powerful aromatic or stimulant tonic (see the effects of the *aromatic bitters*). Its aromatic or stimulant properties depend on the volatile oil and resin; its tonic operation, on the bitter principle. In its tonic and febrifuge powers it approximates to cinchona bark, but is devoid of astringency. It is less likely to irritate the stomach or to cause constipation than cinchona; but usually keeps the bowels gently open. In full doses it is capable of nauseating and purging. Dr. Hancock says the warm infusion causes sweating and diuresis. In its combination of tonic and aromatic properties, it is most allied to cascarilla. In its stomachic qualities it approaches calumba.

USES.—Angustura bark is but little employed by practitioners of this country. We may fairly ascribe this in part to the serious consequences which have resulted from the use of the false angustura, and in part to the belief that we have other remedies of equal, if not of superior, efficacy to it. In some of the continental states, its employment has been prohibited. It may be administered as a febrifuge *in intermittents and remittents*, especially in the worst forms of the bilious remittents of tropical climates. Drs. Williams,[4] Wilkinson,[5] Winterbottom,[6] and, more recently, Dr. Hancock, have spoken in the highest terms of its efficacy. In some of these cases it is said to have proved greatly superior to cinchona. It sits more readily on the stomach, and does not cause constipation like the latter, but keeps the bowels gently open. *In adynamic continued fever*, especially when complicated with great disorder of the digestive organs (manifested by vomiting or purging), it has been used with good effect.[7] As an aromatic tonic and stomachic, *in general relaxation and muscular debility*, and *in atonic conditions of the stomach and intestinal tube* (as some forms of dyspepsia and anorexia), it has been employed with great success. It has also been administered *to check profuse mucous discharges*, as in the latter stages and chronic forms of dysentery and diarrhœa, and in chronic bronchial affections attended with excessive secretion of mucus. In fine, angustura is applicable to any of the purposes for which other vegetable tonics (especially cascarilla, calumba, and cinchona) are commonly employed.

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[1] Pfaff, *op. supra cit.* Bd. ii. 61 and 69; and Bd. vi. 191.
[2] *Journ. de Chim. Méd.* ix. 388.
[3] Pfaff, *op. supra cit.* vi. 191.
[4] *Lond. Med. and Phys. Journ.* 1798, part ii. p. 158.
[5] *Ibid.* 1790, part iv. p. 331.
[6] *Med. Facts and Obs.* vii. 41.
[7] Winterbottom; also Lettsom, *Mem. of the Med. Soc. of Lond.* iv. 191.

ADMINISTRATION.—It may be given *in powder* in doses of from grs. x. to ʒss. But the *infusion* and *tincture* are better preparations.

1. INFUSUM CUSPARIÆ, L. E.; *Infusion of Cusparia.* (Cusparia, bruised, ʒv.; Boiling [distilled, *L.*] Water, Oj. Macerate for two hours in a lightly covered vessel, and strain [through linen or calico, *E.*] —Tonic, stomachic, and stimulant. Used in low fever, bilious diarrhœas and dysenteries, muscular debility, dyspepsia, &c.—Dose, from f℥j. to f℥ij. Tincture of cinnamon is an agreeable addition to it.

2. TINCTURA CUSPARIÆ. E.; *Tincture of Cusparia.* (Cusparia, in moderately fine powder, ℥ivss.; Proof Spirit, Oij. This tincture is to be made like the tincture of cinchona, and most expeditiously by the process of percolation, *E.*)—Tonic, stimulant, and stomachic. Generally employed as an adjunct to bitter infusions.—Dose fʒj. to fʒij.

OTHER MEDICINAL RUTACEÆ.

The root of DICTAMNUS FRAXINELLA, or *Bastard Dittany*, was formerly employed in medicine, but of late years has fallen into almost total disuse. There are two varieties of this plant: *α. purpurea* with purple flowers; and *β. alba* with white flowers. It is a native of the South of Europe. The root contains *volatile oil*, *resin*, *bitter extractive*, and probably *gum*. It is an aromatic tonic, and is reputed to possess antispasmodic, diuretic, and emmenagogue properties. It was formerly employed in intermittents, epilepsy, hysteria, amenorrhœa, chlorosis, and worms. The dose of it is from ℈j. to ʒj. Attention has been drawn to it by Dr. Aldis,[1] who states that it had been employed, during forty years, with great success, in the cure of epilepsy, by Baron A. Sloet van Oldruitenborgh and family.[2] A young lady took it for six months without receiving any ultimate benefit from it.

ORDER LXIX. ZYGOPHYLLACEÆ, *Lindley*.—THE BEAN CAPER TRIBE.

ZYGOPHYLLEÆ, *R. Brown*.

CHARACTERS.—*Sepals* 5, distinct, or scarcely coherent at the base. *Petals* 5, alternate with the sepals, inserted on the receptacle. *Stamens* 10, distinct, hypogynous, 5 opposite to the sepals, and 5 to the petals. *Ovary* distinct, 5-celled; *styles* 5 united into one, sometimes rather distinct at the apex. *Capsule* of five carpels, which are more or less adnate to each other and to the central axis; cells dehiscent at the superior angle, usually many-seeded, or 1-seeded, neither cocculiferous nor arilliferous. *Seeds* albuminous, or commonly exalbuminous; *embryo* straight; *radicle* superior; *cotyledons* foliaceous.—*Herbs*, *shrubs*, or *trees*. *Leaves* with stipules at the base, usually compound (De Cand.)

PROPERTIES.—The Guaiacums are resinous, and possess stimulant properties.

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[1] *Lond. Med. Gaz.* xix. 142.

[2] See *Lond. Med. and Phys. Journ.* xlvi. 605.

306. GUAIACUM OFFICINALE, *Linn. L. E. D.*—OFFICINAL GUAIACUM.

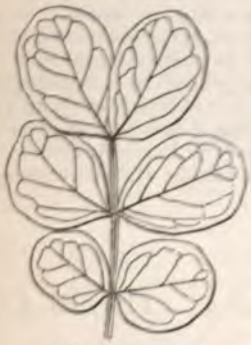
Sex. Syst. Decandria Monogynia.

(Lignum; Resina e ligno igne comparata, *L.*—Resin obtained by heat from the wood, *E.*—Wood and resin, *D.*)

HISTORY.—The Spaniards derived their knowledge of the medicinal uses of Guaiacum from the natives of St. Domingo, and introduced this remedy into Europe in the early part of the sixteenth century (about 1508). The first importer of it was Gonsalvo Ferrand, who, being infected with the venereal disease, and not obtaining any cure for it in Europe, went to the West Indies, to ascertain how the natives in that part of the world treated themselves, as the disease was as common with them as small-pox with Europeans. Having ascertained that Guaiacum was employed, he returned to Spain and commenced practitioner himself. "I suppose," says Freind,[1] "he might make a monopoly of it; for it appears that some time after, it was sold for seven gold crowns a pound."

BOTANY. **Gen. Char.**—*Calyx* 5-partite, obtuse. *Petals* 5. *Stamens* 10; *filaments* naked, or somewhat appendiculate. *Style* and *stigma* 1. *Capsule* somewhat stalked, 5-celled, 5-angled, or by abortion 2- or 3-celled. *Seeds* solitary in the cells, affixed to the axis, pendulous; *albumen* cartilaginous, with small chinks; *cotyledons* somewhat thick.—*Trees* with a hard wood. *Leaves* abruptly pinnate. *Peduncles* axillary, 1-flowered (De Cand.)

FIG. 76.



Guaiacum Leaf.

Sp. Char.—*Leaves* bijugate: *leaflets* obovate or oval, obtuse (De Cand.)

A *tree* rising 30 or 40 feet high. *Stem* commonly crooked; bark furrowed; wood very hard and heavy. *Leaves* evergreen. *Flowers* 6 to 10 in the axillæ of the upper leaves. *Peduncles* an inch and a half long, unifloral. *Sepals* 5, oval. *Petals* 5, oblong or somewhat wedge-shaped, pale blue. *Stamens* somewhat shorter than the petals. *Ovary* compressed, 2-celled; *style* short, pointed. *Capsule* obovate, coriaceous, yellow.

Hab.—St. Domingo and Jamaica.

DESCRIPTION AND COMPOSITION.—In this country the *wood* and the *resin* only are officinal; but on the continent the *bark* also is used. They are imported from St. Domingo.

1. **Guaiacum Wood** (*Lignum Guaiaci*). This is commonly termed *lignum vitæ.*—It is imported in large logs or billets, and is extensively used for making pestles, rulers, skittle-balls, and various other articles of turnery ware. On examining the transverse sections of these stems,

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[1] *Hist. of Physick,* 2d edit. part ii. p. 365.

hardly any traces of medulla or pith are observable, while the annual or concentric layers or zones are extremely indistinct. The wood is remarkable, says Dr. Lindley,[1] "for the direction of its fibres, each layer of which crosses the preceding diagonally; a circumstance first pointed out to me by Professor Voigt." This fact, however, was noticed by Brown[2] above fifty years ago. The distinction between the young and old wood is remarkable. The young wood (called *alburnum* or *sapwood*) is of a pale yellow colour; while the old wood (called *duramen* or *heartwood*) which forms the central and principal part of the stem is of a greenish brown colour, in consequence of the deposition of resinous matter, first in the ducts and subsequently in all parts of the tissue. By boiling a thin shaving of the wood in nitric acid, the whole of the deposited matter is destroyed, and the tissue restored to its original colourless character.

Shavings, turnings, or *raspings of guaiacum* (*lignum guaiaci raspatum* seu *rasum; rasura* vel *scobs guaiaci*) are prepared by turners for the use of druggists and apothecaries. They are distinguished from the raspings of other woods by nitric acid, which communicates to them a temporary bluish-green colour. A decoction of the shavings is yellowish, and does not change colour in the air, and very little even by nitric acid, though after some time it becomes turbid. Neither a solution of emetic tartar, nor the tincture of nutgalls, causes any precipitate. The ferruginous salts deepen its colour.

Trommsdorff[3] analysed the wood, and found it to consist of *resin* 26·0, *bitter, piquant extractive* 0·8, *mucous extractive with a vegetable salt of lime* 2·8, *colouring matter* (?) similar to that of the bark 1·0, and *woody fibre* 69·4.

GUAIACUM BARK (*Cortex Guaiaci*) is grey, compact, very hard, heavy, and resinous. Its internal surface sometimes presents numerous small, brilliant, apparently crystalline points, which Guibourt supposes to be benzoic acid. Trommsdorff[4] analysed this bark, and found it to consist of the following substances: — *peculiar resin*, different from that of the wood, 2·2, *peculiar, bitter, piquant extractive* precipitable by acid 48, *gum* 0·8, *brownish yellow colouring matter* 4·1, *mucous extractive with sulphate of lime*, 12·0, and *lignin* 76·0.

2. **Guaiacum Resin** (*Resina Guaiaci*). — This is commonly, though very erroneously, denominated *gum guaiacum*. It is obtained from the stem of the tree by the following methods: —

α. *By natural exudation.* — It exudes naturally from the stem, and may be seen on it at all seasons of the year.[5] β. *By jagging.* — If the tree be wounded in different parts, a copious exudation takes place from the wounds, which hardens by exposure to the sun. This operation is performed in May.

γ. *By heat.* — Another method of obtaining it is the following: — "The trunk and larger limbs being sawn into billets of about three feet long, an auger hole is bored lengthwise in each, and one end of the billet so placed on a fire that a calabash may receive the melted resin which runs through the hole as the wood burns."[1] δ. *By boiling.*—It is also obtained in small quantities by boiling chips or sawings of the wood in water with common salt. The resin swims at the top and may be skimmed off.[2] The salt is used to raise the boiling point of the water.

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[1] *Nat. Syst. of Botany*, 2d edit. p. 134.
[2] *Nat. Hist. of Jamaica*, p. 226.
[3] *Journ. de Chim. Méd.* vi. 430.
[4] *Ibid.* vii. 429.
[5] Brown, *op. supra cit.* p. 226.

Guaiacum occurs in tears and in masses. *Guaiacum in tears* (*Guaiacum in lachrymis*) occurs in rounded or oval tears, of varying size, some being larger than a walnut. Externally they are covered by a greyish dust. They are said to be produced by *Guaiacum sanctum.*[3] *Lump Guaiacum* (*Guaiacum in massis*) is the ordinary kind met with in the shops. These masses are of considerable size, and are ordinarily mixed with pieces of bark, wood, and other impurities; they are of a brownish or greenish-brown colour, and have a brilliant, shiny, resinous fracture. Thin laminæ are nearly transparent, and have a yellowish-green colour. The odour is balsamic, but very slight, though becoming more sensible by pulverisation. When chewed, guaiacum softens under the teeth, but has scarcely any taste, though it leaves a burning sensation in the throat. Its specific gravity is 1·2289. When heated, guaiacum melts and evolves a fragrant odour. The products of the destructive distillation of guaiacum have been examined both by Mr. Brande and Unverdorben. Among the new substances obtained by the latter are *two empyreumatic oils of guaiacum* (one volatile, the other fixed,) and *pyroguaiacic acid.*

The characters of guiacum resin, according to the *Edinburgh Pharmacopœia,* are as follows:—"Fresh fracture red, slowly passing to green: the tincture slowly strikes a lively blue colour on the inner surface of a thin paring of a raw potato."

In 1805, Mr. Brande[4] analysed guaiacum. In 1806 it was examined by Bucholz,[5] and in 1828 by Buchner.[6] Dr. Ure[7] has made an ultimate analysis of it.

Brande's Analysis.	
Substance *sui generis* (guaiacum properly so called)	91
Extractive	9
Guaiacum	100

Buchner's Analysis.		
Pure Resin		79·8
Bark 20·1	Woody fibre	16·5
	Tasteless gum	1·5
	Extractive	2·1
Guaiacum		99·9

Ure's Analysis.	
Carbon	67·88
Hydrogen	7·05
Oxygen	25·07
Guaiacum	100·00

GUAIACIC ACID: *Guaiacin.* [*Guajacene* $C_{10}H_{8}O_{2}$ Gmelin.]—Is insoluble in water, but is readily dissolved by alcohol, and is precipitated from its alcoholic solution by water, sulphuric and nitric acids, and chlorine. Ether dissolves the resin, but not so readily as alcohol. Solutions of the caustic alkalies (potash and soda) dissolve it, forming *alkaline guaiacates* (*guaiacum soaps; sapones guaiacini*). The mineral acids precipitate it from its alkaline solution. Various salts (as acetate of baryta, acetate of lime, acetate of lead, nitrate of silver, and chloride of gold) occasion precipitates (*guaiacates*) with the alkaline solution. Guaiacic acid is remarkable for the changes of colour it undergoes by the influence of various agents. Thus, its powder, and paper moistened with its tincture, become *green* in air or oxygen gas, but not in carbonic acid gas. This change, which seems connected with the absorption of oxygen, is influenced by the intensity and colour of the light. Various substances give a *blue* tint to guaiacum when in contact with air: thus gluten, but not starch. Hence powdered guaiacum has been proposed as a test for the goodness of wheaten flour (which contains gluten), and of the purity of starch. Gum arabic, dissolved in cold water, has the same effect as gluten, but tragacanth gum has not. Milk, and various fresh roots and underground stems (for example those of the horseradish, potato, carrot, and colchicum) also possess this property. Certain agents change the colour of guaiacum successively to *green*, *blue*, and *brown*: thus, nitric acid and chlorine. Nitric acid colours the tincture of guaiacum green, then blue, and afterwards brown. If a piece of paper moistened with the tincture be exposed to the fumes of the acid, its colour is immediately changed to blue. Spirit of nitric ether usually gives a blue colour to tincture of guaiacum. Mr. Brande has conjectured, and I think with great probability, that these different coloured compounds are combinations of oxygen with guaiacum,—the green compound containing the least, the brown the most, while the blue is intermediate. Mr. Johnson[1] says guaiacum resin consists of $C^{40}H^{23}O^{10}$; its equivalent, therefore, is 343. According to Unverdorben the resin of guaiacum is of two kinds: *one* readily soluble in a solution of ammonia,—and another which forms with ammonia a tarry compound. Pagenstecher has shown that tincture of guaiacum with hydrocyanic acid and sulphate of copper produces an intense blue colour. [According to Berzelius, that part only of the resin which is soluble in ammonia undergoes the changes of colour. These changes have been recently investigated by Mr. Jonas. He confirms the view that they depend on a process of oxidation,—blue, yellow, and red colours being produced, by the combinations of which the green and violet tints are formed. The colours may be brought out by employing the powder or alcoholic solution: they are brought out slowly in the atmosphere,—readily by oxidizing agents, but not by a current of oxygen. The inorganic agents which produce the colours are; atmospheric air (slowly), ozone, hyponitrous ether, chlorides of iron, mercury, copper, and gold, and the alkaline hypochlorites (hypochlorite of soda). Dr. Schmidt takes advantage of this latter reaction to detach guaiacum resin, when used for adulterating jalap or scammony. When hypochlorite of soda is added to a solution of the resin, if guaiacum be present only in the proportion of $\frac{1}{310}$ part, the liquid, according to him, will assume a green colour. For the detection of this resin under ordinary circumstances, the following plan is recommended. Strips of very clean filtering-paper are soaked in a weak alcoholic solution of the resin, and immediately, while still moist, are introduced into a vessel half filled with solution of chlorine without touching it. The blue and white colours are produced.[2]—ED.]

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[1] Wright, *Med. Plants of Jamaica.*

[2] Wright, *op. supra cit.*

[3] *Journ. de Pharm.* xx. 520.

[4] *Phil. Trans.* for 1806, p. 89.

[5] Quoted by Schwartze, *Pharm. Tabell.* 2te Ausg. p. 293.

[6] Gmelin, *Handb. d. Chem.* ii. 571.

[7] *Dict. of Chem.*

2. EXTRACTIVE.—This is extracted from guaiacum by the agency of water. The quantity obtained is liable to variation. It is a brown acrid substance.

These observations, then, show that guaiacum is essentially a *peculiar resin*, mechanically mixed with variable but small quantities of extractive and other impurities.

ADULTERATION.—Various adulterations are described as being practised on guaiacum. Although I have found this substance in the shops of this country of unequal degrees of impurity, I have never had reason to suspect that sophistication had been practised on it. The presence of turpentine resin might be detected by the peculiar odour evolved when the suspected resin is heated. Another mode of detecting this fraud is to add water to the alcoholic solution of the suspected guaiacum, and to the milky liquid thus formed a solution of caustic potash is to be added until the liquor becomes clear. If now an excess of potash cause no precipitate, no resin is present; for while *guaiacate of potash* is soluble in water, the salt produced by the union of potash and resin is not completely so. [When it is suspected that the shavings of other woods are intermixed with guaiacum wood, Heraut recommends that the wood should be treated with a solution of chloride of lime. Guaiacum assumes a green colour in a few seconds, other woods remain unchanged.[1] — ED.]

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[1] *Proceed. of the Royal Soc.* June 18, 1840.

[2] *Pharmaceutical Journal*, vol. xi. p. 523.

[It is stated that no adulterations take place in this country, but guaiacum is imported in all possible degrees of purity and impurity, the prices ranging from two pence to two shillings per pound, the ordinary and middling sorts being heavy, and much mixed with earth and other impurities. It is imported in boxes, cases, and casks, of various weights, chiefly from St. Domingo and Cuba. The pieces imported are generally of from four to five feet in length, and from three to fifteen inches in diameter. It is extensively used for ship blocks, the Cuba wood being preferred, because it consists almost entirely of the hard brown or heart-wood. — ED.]

PHYSIOLOGICAL EFFECTS. — 1. **Of the Resin.** — Guaiacum resin is an acrid stimulant. Its acridity depends in a great measure on the extractive with which the resin is mixed, or which resides in the fragments of bark contained in the resin.

Under the use of *small* and *repeated doses* of guaiacum, various constitutional diseases sometimes gradually subside, and a healthy condition of system is brought about with no other sensible effect of the remedy than perhaps the production of some dyspeptic symptoms, and a slight tendency to increased secretion. We designate this inexplicable, though not less certain, influence over the system, by the term *alterative*. When we give guaiacum in *moderately large doses*, or to plethoric easily-excited individuals, we observe the combined operation of an acrid and stimulant. The local symptoms are, the dryness of the mouth, the sensation of heat at the stomach, nausea, loss of appetite, and a relaxed condition of bowels. The stimulant operation is observed partly in the vascular system, but principally in the exhaling and secreting organs, especially the skin and kidneys. Dr. Cullen justly observes that it seems to stimulate the exhalants more in proportion than it does the heart and great arteries. If diluents be exhibited, and the skin kept warm, guaiacum acts as a powerful sudorific; whereas, when the surface is kept cool, perspiration is checked, and diuresis promoted. By continued use it has caused a mild salivation.[2] The stimulant influence of guaiacum is extended to the pelvic vessels, and thus the hemorrhoidal and menstrual discharges are somewhat promoted by it. But there is no reason for supposing that the pelvic organs are specifically affected by it. In *very large doses* guaiacum causes heat and burning in the throat and stomach, vomiting, purging, pyrexia, and headache. In its operation on the system guaiacum is allied to the balsams. Dr. Cullen considered its resinous part to be very analogous to the balsams and turpentines.

2. **Of the Wood.** — The operation of the wood is similar to, though milder than, that of the resin. Any activity which the wood communicates to boiling water must depend on the extractive, as the resin is not soluble in this fluid. Pearson[3] says, that the decoction excites a sensation of warmth in the stomach, produces dryness of the mouth, with

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[1] *Pharmaceutical Journal*, vol. xii. p. 450.

[2] Burdach, *Syst. d. Arzneim.* Bd. ii. S. 283.

[3] *Observ. on the Effects of Various Articles of the Mat. Med.* p. 8, Lond. 1800.

thirst, increases the natural temperature of the skin, renders the pulse more frequent, and, if the patient lie in bed and take the decoction warm, it proves moderately sudorific; but if he be exposed freely to the air, it acts as a diuretic. Continued use occasions heartburn, flatulence, and costiveness. Kraus[1] mentions a measle-like eruption over the whole body, as being produced by large doses of the wood.

3. **Of the Bark.** — The bark acts in a similar way to the wood. Regnandot[2] injected, at eight in the morning, three ounces of an aqueous infusion of it into the veins of a young man twenty years of age. In half an hour a shivering fit came on, with colicky pains, followed by two stools: this shivering remained till five o'clock in the evening.

USES. — In the employment of guaiacum the acrid and stimulant properties of this resin are to be remembered. The first unfits it for use in cases of impaired digestion, where there is irritation or great susceptibility of, or inflammatory tendency in, the alimentary canal: the second renders it improper in plethoric individuals, in all states of excitement or acute inflammation, and in persons whose vascular system is easily excited, and who are disposed to hemorrhages. It is admissible and useful, on the other hand, in atonic or chronic forms of disease, with retained secretions, especially in relaxed and phlegmatic constitutions.

The following are some of the diseases in which it has been employed: —

1. *In chronic rheumatism*, especially when occurring in scrofulous subjects, or in persons affected with venereal disease, guaiacum may be administered with considerable advantage under the conditions before mentioned. In cases of great debility, with coldness of surface, and in old persons, the ammoniated tincture may be employed.

2. *In gout.* — As a preventive of gout it was introduced by Mr. Emerigon, of Martinico.[3] His remedy (the *specificum antipodagricum Emerigonis*, as our German brethren term it) consisted of two ounces of guaiacum digested for eight days in three pints avoirdupois of rum. The dose was a table-spoonful, taken every morning fasting for a twelvemonth. Its stimulant qualities render it inadmissible during a paroxysm of gout; and with regard to its use in the interval, it is, of course, adapted for chronic atonic conditions only.

3. *In chronic skin diseases*, where sudorifics and stimulants are indicated, guaiacum may be serviceable, especially in scrofulous and syphilitic subjects.

4. *In obstructed and painful menstruation* not arising from any plethoric, inflammatory, or congested state of system, the volatile tincture of guaiacum has been employed with advantage. Dr. Dewees[4] states that he has long been in the habit of employing it in painful menstruation with good effect. Drs. Macleod and Jewell have also borne testimony to its emmenagogue qualities.

[5. *In sterility.* — Dr. Hubbard states that he has in some cases found the volatile tincture of guaiacum a very effectual remedy in cases where the woman had previously suffered from dysmenorrhœa — giving it about three weeks prior to the expected menstrual period.[1]—ED.]

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[1] *Heilmittellehre*, 612.

[2] Wibmer, *Wirk. d. Arzn. u. Gifte*, Bd. ii. S. 411.

[3] *Journ. de Med.* xlvii. 424.

[4] *Treatise on the Diseases of Females*, 2d edit. p. 81, 1828.

6. *As a remedy for venereal diseases*, guaiacum wood was at one time in the greatest repute. Nicholas Poll[3] tells us, that within nine years from the time of its introduction into Europe, more than three thousand persons had derived permanent benefit from its use. Experience, however, has taught us the true value of this remedy, and we now know that it has no specific powers of curing or alleviating syphilis. It is applicable, as an alterative and sudorific, for the relief of secondary symptoms, especially venereal rheumatism and cutaneous eruptions, more particularly of scrofulous subjects. Mr. Pearson found it serviceable after the patient had been subjected to a mercurial course. Under its use, thickening of the ligaments and periosteum subsided, and foul indolent sores healed. During its administration the patient should adhere to a sudorific regimen.

7. *In scrofula*, especially that form called cutaneous, guaiacum is used with occasional advantage.

8. *In chronic pulmonary catarrh*, especially of gouty subjects, it has also been used.

ADMINISTRATION. — The *powder* of guaiacum resin may be given in doses of from grs. x. to ʒss. It may be administered in the form of pill, bolus, or mixture (see *Mistura Guaiaci*). The resin is a constituent of the *Pilulæ hydrargyri chloridi compositæ*, Ph. L., commonly termed *Plummer's Pills*, and of the *Pulvis aloës compositus*. The resin is also given in the form of *alcoholic* and *ammoniated tincture*. The wood is exhibited in *decoction* only. It is a constituent of the *Decoctum sarzæ compositum*, L.

1. MISTURA GUAIACI, L. E.; *Guaiacum Mixture.* (Guaiacum, ʒiij.; Sugar, ℥ss.; Acacia Powder, ʒij.; Cinnamon Water, Oj. [f℥xixss. *E.*] Rub the guaiacum with the sugar and acacia, and to these, while rubbing, add gradually the cinnamon water.)—Dose, f℥ss. to f℥ij. twice or thrice a-day.

2. TINCTURA GUAIACI, E. D.; *Tincture of Guaiacum.* (Guaiacum in coarse powder, ℥vij. [℥viij. *D.*]; Rectified Spirit, Oij. Digest for seven days, *E.* [fourteen days, *D.*], and then filter [strain, express, and filter, *D.*])—Stimulant, sudorific, and laxative. Dose, fʒj. to fʒiv. As it is decomposed by water, it should be administered in mucilage, sweetened water, or milk, to hold the precipitated resin in suspension.

3. TINCTURA GUAIACI COMPOSITA, L.; *Compound Tincture of Guaiacum; Tinctura Guaiaci Ammoniata*, E.; *Volatile Tincture of Guaiacum.* (Guaiacum in coarse powder, ℥vij.; Aromatic Spirit of Ammonia, Oij. [Spirit of Ammonia, Oij. *E.*] Digest for seven days [in a well-closed vessel, *E.*], and then filter.)— A powerfully stimulating sudorific and emmenagogue. — Dose, fʒss. to fʒij. May be taken as the preceding.

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[1] *Med. Times and Gazette*, Nov. 8, 1856.

[2] Quoted by Pearson, *op. supra cit.*

4. DECOCTUM GUAIACI, E.; *Decoction of Guaiacum.* (Guaiacum turnings, ℥iij.; Raisins, ℥ij.; Sassafras, rasped, ℥j.; Liquorice Root, bruised, ℥j.; Water, Oviij. Boil the guaiacum and raisins with the water gently down to Ov., adding the liquorice and sassafras towards the end. Strain the decoction.)—This is the old *Decoction of the Woods.* The resin of guaiacum being insoluble in water, the extractive alone is dissolved by this menstruum. The sassafras can confer but little activity on the preparation. Taken in doses of f℥iv., four times daily, and continued with a sudorific regimen, it acts on the skin, and has been thought to be useful as an alterative in old venereal, rheumatic, and cutaneous diseases.

ORDER LXX. OXALIDACEÆ, *Lindley.* — THE WOOD-SORREL TRIBE.

OXALIDEÆ, *De Candolle.*

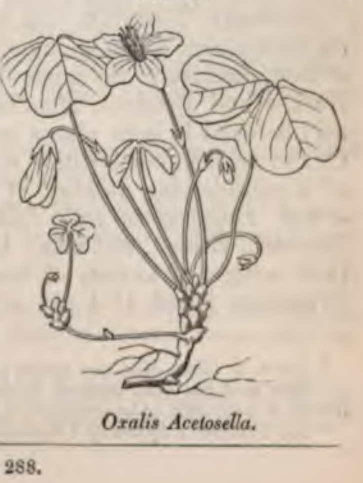
CHARACTERS. — *Sepals* 5, sometimes slightly cohering at the base, persistent, equal. *Petals* 5, hypogynous, equal, unguiculate, with a spirally-twisted æstivation. *Stamens* 10, usually more or less monadelphous, those opposite the petals forming an inner series, and longer than the others; *anthers* 2-celled, innate. *Ovary* with 5 angles and 5 cells; 5 *styles* filiform; *stigmas* capitate or somewhat bifid. *Fruit* capsular, membranous, with 5 cells, and from 5 to 10 valves. *Seeds* few, fixed to the axis, enclosed within a fleshy integument, which curls back at the maturity of the fruit, and expels the seeds with elasticity. *Albumen* between cartilaginous and fleshy. *Embryo* the length of the albumen, with a long radicle pointing to the hilum, and foliaceous cotyledons. — *Herbaceous plants, under-shrubs*, or *trees*. *Leaves* alternate, compound, sometimes simple by abortion, very seldom opposite or somewhat whorled (Lindley).

PROPERTIES. — Acidulous and refrigerant.

307. OXALIS ACETOSELLA, *Linn.* — COMMON WOOD-SORREL.

Sex. Syst. Decandria Pentagynia.

FIG. 77.



Oxalis Acetosella.

HISTORY.—Mr. Bicheno[1] declares this to be the genuine shamrock.

BOTANY. **Gen. Char.** — *Sepals* 5, free or united at the base. *Petals* 5; *Stamens* 10; *filaments* slightly monadelphous at the base, the five external alternate ones shorter. *Styles* 5, pencilled at the apex or capitate. *Capsule* pentagonal, oblong, or cylindrical (De Cand.)—Perennial *herbs*. *Leaves* never abruptly pinnate.

Sp. Char. — *Leaves* all radical, ternate; *leaflets* inversely heart-shaped, hairy. *Scape* single-flowered. *Root* [rhizome] scaly (Hooker).

An elegant little plant. *Leaflets* delicate bright green, often purplish at the back, drooping at night. *Footstalks* slender, purplish. *Bracts* 2, scaly. *Flowers* drooping, white, with purplish veins.

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[1] *Phil. Mag.* new series, vii. 288.

Hab.—Indigenous; woody and shady places. Flowers in May.

DESCRIPTION.—Woodsorrel (*herba acetosellæ*) is odourless. Its taste is agreeably acidulous.

COMPOSITION.—I am unacquainted with any analysis of this plant. Its expressed juice yields by evaporation *binoxalate of potash.* Payen[1] analysed *Oxalis crenata.* From its stems he obtained *water, lignin, oxalate of potash, albumen, soluble nitrogenous matter, chlorophylle, oxalate of ammonia, free oxalic acid, oxides, salts, gum, an aromatic substance,* and *sugar.* The quantity of oxalate of potash was from 1·06 to 1·23 per cent.

BINOXALATE OF POTASH; *Salt of Woodsorrel.*—In Switzerland and some parts of Germany this salt is obtained on the large scale from woodsorrel, by evaporating the expressed juice, redissolving the residue, and crystallising. Five hundred parts of the plant yield four parts of the crystallised salt. It crystallises in white rhombic prisms. It consists of—

	Atoms.	*Eq. Wt.*
Oxalic Acid	2	72
Potash	1	48
Water	2	18
Crystallised binoxalate potash	1	138

In commerce the quadroxalate of potash is substituted for it.

PHYSIOLOGICAL EFFECTS AND USES.—Woodsorrel is refrigerant. Taken as a salad, it is considered a good antiscorbutic. Infused in milk, to form whey, or in water, it furnishes a grateful drink in fevers. A solution of the binoxalate of potash has been employed as a substitute for lemonade. [It is a poisonous salt, and has given rise to several fatal accidents.—ED.]

308. ACIDUM OXALICUM.[2]—OXALIC ACID.

HISTORY.—This acid was discovered by Scheele, though the credit of its discovery was for a long time given to Bergmann.[3]

NATURAL HISTORY.—It is found in both kingdoms of nature. *In the Inorganised Kingdom,* oxalic acid, in combination with the protoxide of iron, constitutes the mineral denominated by Rivero, *Humboldtine;* by Necker and Beudant, *Humboldtite. In the Organised Kingdom,* oxalic acid is found in both plants and animals, but principally in the former. Oxalic acid, in combination with either lime or potash, is a constituent of a considerable number of plants, especially those belonging to the orders *Polygonaceæ* and *Lichenaceæ.* Oxalate of lime is found in Rhubarb, Bistort, and many Lichens. Some lichens contain nearly half their weight of oxalate of lime. In *Variolaria faginea* (V. communis), Braconnot found 47·4 per cent. of this salt. Combined with potash, oxalic acid is found in *Oxalis Acetosella*, *Rumex Acetosa*, and Rhubarb. Oxalate of soda is found in *Salsola*. A solution of free oxalic acid is said to exude from the hairs of *Cicer Arietinum*, but the accuracy of the statement is doubtful. Oxalate of lime constitutes the Mulberry Calculus, and is found in the Liquor Allantoidis of the cow.

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[1] *Journ. de Chim. Méd.* new series, i. 260.

[2] This acid has been omitted, inadvertently I presume, in the Edinburgh Pharmacopœia, though it is directed to be employed in the preparation of oxalate of ammonia.

[3] See Thomson's *System of Chemistry,* vol. ii. p. 15, 7th ed. Lond. 1831.

PREPARATION.—Oxalic acid is obtained by the action of nitric acid on sugar or potato starch. Treacle is usually employed in this country as a substitute for solid sugar. The process is generally conducted in open earthenware jars, heated by a warm water-bath. The nitrous vapours evolved are usually allowed to escape into the air. In France, attempts have been made to economise them by their employment in the manufacture of sulphuric acid (see *Sulphuric Acid*). To prevent their noxious influence on the workmen and the surrounding neighbourhood, as well as to economise them, a patent has been taken out to conduct the process in closed vessels connected with receivers and condensers, by which the vapours are condensed and collected again to be used.[1] Oxalic acid is also obtained by digesting, by aid of a gentle heat, one part of sugar, or, better still, of potato starch, in 5 parts of nitric acid of sp. gr. 1·42, diluted with 10 parts of water, as long as gaseous products are evolved; by evaporation the acid is obtained in crystals, which may be purified by a second crystallisation, after being well dried on paper or porous earthenware. From 12 parts of potato starch, 5 of the acid are obtained. The mother liquor should be treated with an additional quantity of acid, and again warmed, when a second crop of crystals will be obtained: this is repeated until the solution is quite exhausted.[2]

The formation of oxalic acid depends on the oxidation of organic matter, at the expense of part of the oxygen of the nitric acid, while nitrous vapours are given out. Those organic matters, as sugar and starch, which contain oxygen and hydrogen in the same proportion as water, yield it in the greatest quantity. One equivalent of anhydrous sugar ($C^{12}H^{9}O^{9}$), and eighteen equivalents of oxygen (O^{18}), contain the elements of six equivalents of anhydrous oxalic acid ($6C^{2}O^{3}$), and nine equivalents of water ($9HO$). But the process is not so simple as this calculation would lead us to suppose. Part of the carbon of the sugar escapes in the form of carbonic acid gas. The mother liquor contains, besides some acetic acid, saccharic acid ($C^{12}H^{5}O^{11}$); which, when acted on by a further portion of nitric, is converted into oxalic and carbonic acids. If the nitrous vapours be conveyed into a condenser, nitric and nitrous acids may be collected.

PROPERTIES.—The crystals of oxalic acid are colourless, transparent prisms, which belong to the oblique prismatic system. They are usually flattened, six-sided (by the truncation of one pair of the lateral edges), and have two or four terminal planes.[3] The crystals of oxalic acid taste and react on vegetable colours powerfully acid. When pure they have no odour. Exposed to warm air they effloresce, evolve 28 per cent. (equal to two equivalents) of water, and become a pulverulent residue (*hydrate of oxalic acid*). When heated rapidly to 350° F. they fuse, evolve water, and the hydrate of the acid sublimes, a portion of it at the same time undergoing decomposition, but no residue being left if the acid be quite pure. They dissolve in from 8 to 11 parts of water at 60° F., in their own weight of boiling water, and in 4 parts of alcohol at 60° F. By the action of oil of vitriol, aided by heat, they are resolved into water, which remains with the sulphuric acid, and equal volumes of carbonic acid and carbonic oxide gases.

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[1] *Repertory of Patent Inventions*, N.S. vol. vii. p. 5, Lond. 1837.—A patent has been taken out for preparing this acid in leaden vessels, and for obtaining it from potatoes (*Ibid.* N.S. vol. xv. p. 363, Lond. 1841).

[2] Liebig, in Turner's *Elements of Chemistry*, p. 698, 7th ed. Lond. 1840.

[3] Crystallised oxalic acid has often been mistaken for sulphate of magnesia, and the consequence has been fatal in many instances. Sulphate of zinc and bicyanide of mercury are likewise apt to be confounded with this acid.

CHARACTERISTICS.—Oxalic acid strongly reddens litmus, and is entirely volatilised by heat. By the effect of heat it is at once known from the sulphates of magnesia and zinc, both of which are fixed. Nitrate of silver added to a solution of it yields a white precipitate (*oxalate of silver*), which is soluble in nitric acid, and when dried and heated on the point of a knife, by the flame of a candle or spirit-lamp, becomes brown on the edge, very feebly detonates, and is completely dissipated, being converted into water, carbonic acid, and metallic silver. With lime water, or a solution of chloride of calcium, oxalic acid yields a white precipitate (*oxalate of lime*), insoluble, or nearly so, in excess of oxalic acid, readily soluble in nitric acid, and slightly so in hydrochloric acid. If the precipitate be collected, dried, and calcined, it yields quicklime. With sulphate of copper, oxalic acid yields a bluish white precipitate (*oxalate of copper*). It reduces the sesquichloride of gold, and deoxidises iodic acid on boiling.

To detect oxalic acid in oxalate of lime, proceed as follows:—Boil the oxalate with a solution of carbonate of potash for two hours, and filter. The liquor contains oxalate and carbonate of potash. Add acetate of lead, collect the precipitate (*oxalate and carbonate of lead*), suspend it in water, through which sulphuretted hydrogen is to be passed; filter (to get rid of the dark sulphuret of lead), boil the clear liquor, which is a solution of oxalic acid, and test as above for the free acid. If the oxalate of lime were mixed with organic matter, the filtered liquor should be feebly acidulated with nitric acid, before adding the acetate of lead. The acidulated liquor should be filtered, rendered faintly alkaline by carbonate of potash, again filtered, and then mixed with acetate of lead, and the precipitate treated as above.

COMPOSITION.—Anhydrous oxalic acid, as it exists in dry oxalate of lead, has the following composition:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	2	12	33·3
Oxygen	3	24	66·6
Anhydrous Oxalic Acid	1	36	100·0

Or,	*Atoms.*	*Eq. Wt.*	*Per Cent.*
Carbonic Acid	1	22	61·1
Carbonic Oxide	1	14	38·9
	1	36	100·0

Crystallised oxalic acid contains three equivalents of water, of two of which it may be deprived by heat, leaving, what has been termed, *hydrate of oxalic acid*. The composition of these two substances is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Anhydrous Oxalic Acid	1	36	57·14
Water	3	27	42·86
Crystallised Oxalic Acid	1	63	100·00

	Atoms.	*Eq. Wt.*	*Per Cent.*
Anhydrous Oxalic Acid	1	36	80
Water	1	9	20
Hydrate of Oxalic Acid	1	45	100

Some chemists regard the hydrate of oxalic acid as a real hydracid, composed of $C^2O^4 + H$. [The formula of this acid, in the anhydrous state, is $2CO + O$, or C^2O^3; Symb. $\bar{O} = $ eq. 36·24. The formula of the hydrated acid, 1 at. $\bar{O} + 1$ eq. HO eq. $= 45{\cdot}24$; and of the crystallised acid, 1 at. $\bar{O} + 3$ eq. HO eq. $= 63{\cdot}24$.—Ed.]

Impurity.—The crystals of oxalic acid of commerce are sometimes contaminated with nitric acid. In this state they have usually a faint odour, and stain the cork of the bottle, in which they are kept, yellow. If they be exposed to a warm atmosphere, the nitric acid escapes along with the water of crystallisation. [The presence of nitric acid may be detected by boiling the crystals with a weak solution of sulphate of indigo. The colour is discharged.—Ed.]

Physiological Effects. α. *On Vegetables.*—A solution of oxalic acid acts as a poison to plants.[1] The acid (solid?) has been said to promote the germination of old seeds;[2] but I suspect the statement to be inaccurate.

β. *On Animals.*—The best series of experiments on the effects of this acid on animals are those of Christison and Coindet.[3] They found that concentrated solutions of half-ounce doses of the acid introduced into the stomachs of cats and dogs caused exquisite pain, violent attempts to vomit, dulness, languor, great debility, and death in from two to twenty minutes. A post-mortem examination of the bodies showed softening and corrosion of the inner coat of the stomach. Large doses of a dilute solution caused great depression of the heart's action; and small doses gave rise to tetanus or narcotism. Furthermore, the acid acts with great violence, and produces nearly the same effects to whatever part of the body it is applied. From these results it has been inferred that the concentrated acid is a corrosive poison,—while the dilute acid ceases to be corrosive, but, becoming absorbed, acts on the brain, spinal cord, and heart. It appears to me absurd to suppose, as is usually done, that a dilute solution ceases to act chemically. It does not, indeed, destroy the gastric membrane as a concentrated solution does, but doubtless it must effect some chemical change on the blood when it gains access to it: though the precise alteration may hitherto have evaded notice. We know that a twentieth part of oxalic acid, added to boiling syrup, renders it thin, and incapable of crystallising; and it is possible that its action on other organic substances may be equally energetic; and thus alterations may be effected in the condition of the blood, which, though not very marked, may nevertheless be sufficient to render this fluid incapable of supporting life.

γ. *On Man.*—The effects of oxalic acid on the human subject vary somewhat with the dose. When this is large and the solution concentrated, acute pain is experienced; but, after small doses and dilute solutions, this symptom is not well marked. Vomiting is usually present. The circulation is always depressed; the pulse being feeble or failing, and the surface cold and clammy. Nervous symptoms (such as lassitude, weakness of the limbs, numbness, pain in the back extending down the thighs, and, towards the end, convulsions) have sometimes, but by no means invariably, made their appearance. But death follows so speedily after the injection of large doses ("few of those who have died survived above an hour," *Christison*), that the symptoms have not been fully made out. If life be prolonged for a few hours, symptoms of gastro-enteritis are observed. Post-mortem examination discovers irritation and often corrosion of the stomach. Some years since I opened the body of a man, who died in twenty minutes after swallowing oxalic acid by mistake for Epsom salts. The post-mortem examination was made a few hours after death, and while the body was quite warm. The stomach presented a diffused redness, like that of a part affected with erysipelas. The epithelium was destroyed, and presented, in patches, the appearance of the scalded cuticle, or of the pellicle which forms on the surface of boiling saline solutions.

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[1] Marcet, quoted by De Candolle, in his *Physiologie Végétale*, t. iii. p. 1355. Paris, 1832.

[2] *Repertory of Patent Inventions*, vol. xiii. p. 408. 1832.

[3] *Edinburgh Medical and Surgical Journal*, vol. xix.—In Wibmer's work (*Die Wirkung*, &c. Bd. iv. S. 35) will be found a notice of the experiments of Rave and Klostermann.

USES.—Oxalic acid is not at the present time used in medicine. In France, *Tablettes d'Acide Oxalique* are prepared. Either free or combined with ammonia, it is a valuable test for lime. It is employed for removing ink stains and iron moulds from linen; for cleaning the leather of boot-tops; and for certain styles of discharge in calico-printing.

ANTIDOTES.—In cases of poisoning by this acid, it is advisable to administer as speedily as possible large quantities of chalk, whiting, or magnesia, suspended in water, by which inert earthy oxalates are formed in the stomach. In the absence of these antidotes, large quantities of warm water may be administered, and at the same time vomiting is to be promoted by tickling the throat. Small quantities of water may prove injurious by favouring absorption. Alkalies do not deprive the acid of its poisonous operation. The stomach pump and emetics may be used, but on account of the rapidity with which this acid acts, it is not advisable to lose time by their application until after the antidote has been administered.

ORDER LXXI. VITACEÆ, *Lindley*.—THE VINE TRIBE.

AMPELIDEÆ, *Kunth*, *De Candolle*.

CHARACTERS.—*Calyx* small, nearly entire at the edge. *Petals* 4 or 5, inserted on the outside of the disk surrounding the ovary; in æstivation turned inwards at the edge, in a valvate manner, and often inflected at the point. *Stamens* equal in number to the petals, and opposite them, inserted upon the disk, sometimes sterile by abortion; *filaments* distinct, or slightly cohering at the base; *anthers* ovate, versatile. *Ovary* superior, 2-celled; *style* 1, very short; *stigma* simple; *ovules* erect, definite. *Berry* round, often by abortion 1-celled, pulpy. *Seeds* 4 or 5, or fewer by abortion, bony, erect; *albumen* hard; *embryo* erect, about one-half the length of the albumen; *radicle* taper; *cotyledons* lanceolate, plano-convex.—Scrambling, climbing *shrubs*, with tumid separable joints. *Leaves* with stipules at the base, the lower opposite, the upper alternate, simple or compound. *Peduncles* racemose, sometimes by abortion changing to tendrils often opposite the leaves. *Flowers* small, green (Lindley).

PROPERTIES.—Acid leaves, and a fruit like that of the common grape, is the usual character of the order (Lindley).

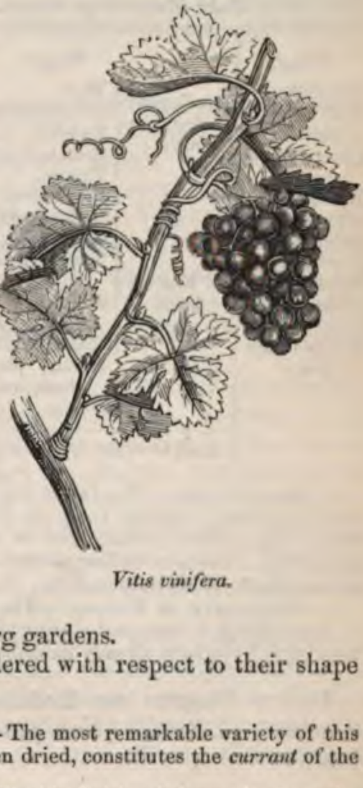
309. VITIS VINIFERA, *Linn. L. E. D.*—**COMMON GRAPE VINE.**

Sex. Syst. Pentandria Monogynia.

(Fructus præparatus, *L.*—Dried fruit, *E.*—The fresh and the dried fruit, *D.*)

HISTORY. — The grape-vine has been known and cultivated from the most remote periods of antiquity. Among the most ancient of the profane writers, Homer,[1] Hippocrates, and Herodotus,[2] may be referred to as speaking of the vine.

FIG. 78.



Vitis vinifera.

BOTANY. **Gen. Char.** — *Calyx* somewhat 5-toothed. *Petals* 5, cohering at the point, separating at the base, and dropping off like a calyptra. *Stamens* 5. *Style* 0. *Berry* 2-celled, 4-seeded; the cells or seeds often abortive (De Cand.)

Sp. Char. — *Leaves* lobed, sinuated, toothed, smooth or downy (De Cand.)

A hardy, exceedingly variable *shrub*. *Leaves* more or less lobed, smooth, pubescent or downy, flat or crisp, pale or intensely green. [*Tendrils* opposite to each footstalk, solitary, spiral.] *Branches* prostrate, climbing or erect, tender or hard. *Racemes* loose or compact, ovate or cylindrical. *Fruit* red, pale, or white, watery or fleshy, globose, ovate or oblong, sweet, musky, or austere. *Seeds* variable in number, or sometimes the whole of them abortive (De Cand.)—No less than 1400 varieties were cultivated at the Luxembourg gardens.

DESCRIPTION.—Grapes (*Uvæ*) considered with respect to their shape and colour, may be thus arranged:[3]—

1. *Round, dark-red, purple, or black grapes.* — The most remarkable variety of this division is the *black Corinthian grape*, which, when dried, constitutes the *currant* of the grocer.
2. *Oval, dark-red, purple, or black grapes.* — To this division belongs the favourite *black Hamburgh grape*.
3. *Round and white grapes.*
4. *Oval and white grapes.* — The *Portugal grape* comes under this division. It is imported, packed in saw-dust, and contained in earthen jars, from Portugal and Spain. The berries are large, fleshy, sweet, and slightly acidulous. They keep a long time after they have ripened. In 1822, the *ad valorem* duty of 20 per cent. on these grapes produced £1720.[4] The *white Cornichon* grape is remarkable for its elongated elliptical berry.
5. *Red, rose-coloured, greyish, or striped grapes.*

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[1] *Od.* vii. 121; and xxiv. 342.
[2] *Euterpe*, lxxvii.
[3] Thomson, in Loudon's *Encycl. of Gardening*.
[4] M'Culloch, *Dict. of Commerce.*

Various parts of the vine, some of which were formerly employed in medicine, are distinguished by peculiar names; thus, the leaves are termed *pampini;* the cirrhi or tendrils, *capreoli;* the tender shoots, *palmites;* the juice or sap, *lachryma;* and the juice of unripe grapes, *omphacium,* or commonly *agresta.*[1] The twigs or cuttings of the vine are used for flavouring vinegar.

COMPOSITION.—The juice of unripe and ripe grapes has been examined by several chemists. The following are the most important results:[2]—

Juice of the Unripe Grape.			*Juice of the Ripe Grape.*	
Proust.	*Geiger.*		*Proust.*	*Bérard.*
Extractive.	1. Deposit from the juice.	Wax.	Extractive.	Odorous matter.
Malic acid, a little.		Chlorophylle.	Sugar (granular and uncrystallisable).	Sugar.
Citric acid, much.		Tannin.	Gum.	Gum.
Bitartrate of potash.		Glutinous matter.	Glutinous matter.	Glutinous matter.
Sulphate of potash.	2. Filtered juice.	Tannin.	Malic acid, a little.	Malic acid.
Sulphate of lime.		Extractive.	Citric acid, a little (tartaric, *Braconnot*).	Malate of lime.
		Sugar (uncrystallisable).	Bitartrate of potash.	Bitartrate of potash.
		Gallic acid.		Supertartrate of lime.
		Tartaric acid (free) about 1·12 per cent.		
		Malic acid (free) about 2·19 per cent.		
		Bitartrate of potash.		
		Malate, phosphate, sulphate, and muriate of lime.		
Unripe Grape juice.	Juice of White Grape of good quality.		Ripe Grape juice.	RipeGrapejuice.

1. **GRAPE SUGAR.**—This is one variety of the *granular* or *crumbling sugars* (*Krümelzuckers*) of the Germans. It agrees with common sugar in its most essential properties, but is less soluble in water and in alcohol than the latter, and does not sweeten so effectually. From its boiling alcoholic solution it is deposited, on cooling, in the form of an irregularly crystalline mass. Its formula is $C^{12}H^{14}O^{14}$.

2. **BITARTRATE OF POTASH.**—The impure bitartrate of potash, called *crude tartar* or *argol,* which is deposited during the fermentation of grape wine, and the purified bitartrate, have been already described.—See vol. i. p. 550.)

DRIED GRAPES OR RAISINS.—Grapes, when properly dried, are denominated *Raisins* (*Uvæ passæ*). Of these there are two principal kinds:—

1. **RAISINS COMMONLY SO CALLED** (*Uvæ passæ majores; Passulæ majores*). In Granada the finest kinds of raisins (viz. the *Muscatels* and the *Blooms*) are sun-dried; while the *Lexias* (so called from the liquor in which they are immersed) are dipped in a mixture of water, ashes, and oil, and afterwards sun-dried.[3] By this treatment the juice exudes and candies on the fruit. Dillon[4] states that the sun-dried raisins have their stalk half cut through while the bunch remains on the vine. The raisins of Valentia are prepared by steeping them in boiling water, to which a lye of vine stems has been added.[5] Some raisins are said to be dried by the heat of an oven. Raisins are imported in casks, barrels, boxes, and jars. The best come in jars and quarter boxes

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[1] Murray, *App. Med.* i. 444.
[2] Gmelin, *Handb. d. Chem.* ii. 1255.
[3] Inglis, *Spain in* 1830, ii. 193.
[4] *Travels through Spain,* p. 376.
[5] Laborde, *A View of Spain,* iv. 99.

weighing twenty-five lbs. The varieties known in the market are distinguished partly from their place of growth, as *Valentias* and *Smyrnas;* partly from the variety of grape from which they are prepared, as *Sultanas*, *Blooms*, and *Muscatels;* and partly from the mode of curing them, as *Raisins of the Sun.* Muscatels are the finest. Sultanas are stoneless. The raisins of Malaga are of three kinds:[1] 1st, *Muscatels;* 2nd *Sun* or *Bloom Raisins* (obtained from a long grape called *Uva larga*); and the *Lexia Raisins.*

2. CORINTHIAN RAISINS OR CURRANTS (*Uvæ passulæ minores; Passulæ minores; Passulæ Corinthiacæ*). These are obtained from a remarkably small variety of grape called the *Black Corinth.* They were formerly produced at Corinth (whence they received their name), but are now grown in Zante, Cephalonia, Patras, &c. At Zante they are gathered in August, disposed in couches on the ground to dry, cleaned, and laid up in magazines (called *seraglios*), where they eventually adhere so firmly as to require digging out.[2] They require eight, ten, or fourteen days for drying.[3] For exportation they are trodden in barrels.

PHYSIOLOGICAL EFFECTS.—*Fresh grapes*, when ripe, are wholesome, nutritious, refrigerant, and, when taken freely, diuretic and laxative. The skin and the seeds are indigestible, and should be rejected. "I think we may assert," says Dr. Cullen,[4] "that grapes which contain a large quantity of sugar are, if taken without their husks, the safest and most nutritive of summer fruits." *Raisins* are somewhat more nutritive, and less refrigerant; for they abound more in sugar, and contain less acid, than the fresh grape; but, if eaten too freely, they are apt to disorder the digestive organs, and cause flatulence. They possess demulcent and emollient qualities.

USES.—Both grapes and raisins are employed at the table as a dessert. They are apt to disagree with dyspeptics and children. Raisins are also used in various articles of pastry. Considered medicinally, *fresh grapes* prove valuable in febrile and inflammatory complaints; they allay thirst, and diminish febrile heat: they have been found serviceable in dysentery[5] and in phthisical complaints.[6] "The subjects of pulmonary affections, who pass the summer in Switzerland," observes Sir J. Clark,[7] "may try the effects of a course of grapes, '*cure de raisins*,' a remedy in high estimation in several parts of the continent."

Raisins are employed in medicine principally as flavouring agents; they enter into several officinal preparations (as *Decoctum Hordei compositum, Decoctum Guaiaci, Tinctura Cardamomi composita, Tinctura Sennæ composita, Tinctura Quassiæ composita*), the flavour of which they improve, though they contribute nothing to the efficacy of these compounds.

1. POTASSÆ BITARTRAS.—See POTASSÆ TARTRAS ACIDA, Vol. I., p. 550.

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[1] Busby's *Journal of a recent Visit to the principal Vineyards of Spain and France*, p. 44. Lond. 1834.

[2] Spon and Wheler, *Voyage d'Italie*, &c. t. i. p. 85–87.

[3] Holland, *Travels in the Ionian Isles*, p. 21; and Williams, *Travels in Italy*, &c. ii. 182.

[4] *Mat. Med.* i. 253.

[5] Zimmerman, *Treat. on Dysent.* 2d edit. p. 87, Lond. 1774.

[6] Moore, *View of Society, &c. in Italy*, ii. 254.

[7] *The Sanative Influence of Climate*, 3d edit. p. 256, 1841.

310. ACIDUM TARTARICUM, *L. E. D.*—TARTARIC ACID.

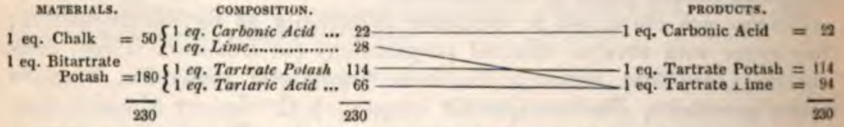
HISTORY.—Tartaric acid was first procured in a separate state by Scheele, in 1770. It is sometimes termed the *crystallised acid of tartar*. [It is abundantly contained in Argol, or the crude tartar, which is deposited during fermentation from the juice of the grape. The purified Argol, or bitartrate of potash, is the principal source of this acid.—ED.]

NATURAL HISTORY.—It is peculiar to the vegetable kingdom. In the *free* state it exists in tamarinds, grapes, the pine-apple, and pepper. It is also found native in combination with bases: thus, *bitartrate of potash* exists in tamarinds, grapes, and mulberries, and *tartrate of lime* in the fruit of *Rhus typhinum*.

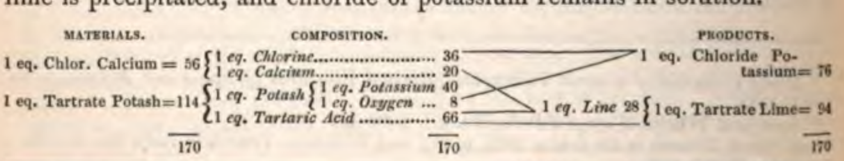
PREPARATION.—The London and Dublin Colleges have placed this acid among the articles of Materia Medica. No formula is given for its preparation. The process of the Edinburgh Pharmacopœia is as follows:[1]—

Take of Bitartrate of Potash, lb. iv.; Boiling Distilled Water, *Cong.* iiss.; Prepared Chalk, ℥xxv. and ʒvj.; Diluted Sulphuric Acid, Ovij. and ℥xvij.; Hydrochloric Acid, f℥xxviss., or as much as may be sufficient. Boil the Bitartrate of Potash with two gallons of Distilled Water, and add, gradually, half the prepared Chalk; then, the effervescence having ceased, add the remainder of the Chalk, previously dissolved in the Hydrochloric Acid, with four pints of the Distilled Water. Lastly, set aside, that the Tartrate of Lime may subside; pour off the liquor, and wash frequently the Tartrate of Lime with Distilled Water, until it be void of taste; then pour on it the diluted Sulphuric Acid, and boil for a quarter of an hour. Evaporate the strained liquor by a gentle heat, that crystals may be formed. Dissolve the crystals, that they may be pure, again, and a third time, in water, and as often strain the liquor, boil down, and set it aside.

The following is the *theory* of the process for making tartaric acid:—By the mutual action of bitartrate of potash and carbonate of lime (chalk), we obtain tartrate of potash in solution, and tartrate of lime precipitated, while carbonic acid escapes.—The following diagram explains these changes:—


MATERIALS.
COMPOSITION.
PRODUCTS.
1 eq. Chalk = 50
1 eq. Carbonic Acid ... 22
1 eq. Lime.................. 28
1 eq. Bitartrate Potash =180
1 eq. Tartrate Potash 114
1 eq. Tartaric Acid ... 66
1 eq. Carbonic Acid = 22
1 eq. Tartrate Potash = 114
1 eq. Tartrate Lime = 94
230
230
230

or $KO,2\bar{T}+CaO,CO^2=CaO,\bar{T}+KO,\bar{T}+CO^2$. If to the solution of tartrate of potash we add chloride of calcium (obtained by dissolving chalk in hydrochloric acid), double decomposition ensues; tartrate of lime is precipitated, and chloride of potassium remains in solution.


MATERIALS.
COMPOSITION.
PRODUCTS.
1 eq. Chlor. Calcium = 56
1 eq. Chlorine........................ 36
1 eq. Calcium.......................... 20
1 eq. Tartrate Potash=114
1 eq. Potash
1 eq. Potassium 40
1 eq. Oxygen ... 8
1 eq. Tartaric Acid 66
1 eq. Chloride Potassium= 76
1 eq. Lime 28
1 eq. Tartrate Lime= 94
170
170
170

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[1] The Edinburgh College employs the same quantity (Ovij. and f℥xvij.) of diluted Sulphuric Acid formerly recommended by the London College; but, as its strength is weaker, the quantity ought to be greater. The "Edinburgh College should have directed more than ten pints of Sulphuric Acid, instead of less than eight" (Mr. R. Phillips, *Lond. Med. Gaz.* new series, vol. ii. 1838–9, p. 689).

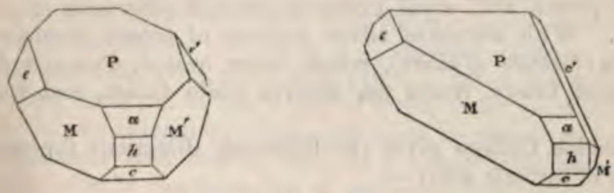
or, $\mathrm{KO,\overline{T}+CaCl=CaO,\overline{T}+K,Cl}$. The tartrate of lime obtained in the above two operations is then decomposed by sulphuric acid, which forms the almost insoluble sulphate of lime, and sets tartaric acid free.

MATERIALS.	COMPOSITION.	PRODUCTS.
1 eq. Tartrate Lime = 94	1 *eq. Tartaric Acid* = 66 1 *eq. Lime* .... = 28	1 eq. Tartaric Acid ...... = 66
1 eq. Sulphuric Acid = 40	....	1 eq. Sulphate Lime ... = 68
134		134

or, $\mathrm{CaO,\overline{T}+SO^3=CaO,SO^3+T}$.

PROPERTIES.—Tartaric acid crystallises in elongated, colourless, inodorous, very sour, imperfectly transparent prisms, which belong to the oblique prismatic system.[1] The crystals are permanent in the air.

FIG. 79. FIG. 80.



Crystals of Tartaric Acid.

Fig. 79. The crystal is usually modified. [The corresponding planes in both figures are marked with the same letters.]

Fig. 80. The same modified form, with the planes irregularly disposed, as they appear in most of the crystals.

When heated they fuse, and undergo chemical changes varying with the degree and continuance of the heat. When they have lost by heat a fourth of their water, they become *tartralic acid*, which has, in its salts, the same composition as tartaric acid, but neutralises one-fourth less base. It differs from tartaric acid, therefore, as pyrophosphoric acid differs from phosphoric acid. When tartralic acid is further heated it loses as much more water, and becomes *tartrelic acid*, which also has, in its salts, the composition of tartaric acid, but only half the neutralising power. It corresponds, therefore, to metaphosphoric acid. By a higher degree of heat all the water of this acid is driven off, and we have *anhydrous tartaric acid*, which, however, has lost its acid properties, and is quite insoluble in water.[2] "This is a powerful argument in favour of the view, according to which all acids are compounds of hydrogen" (Liebig). When subjected to distillation, tartaric acid yields carbonic acid, water, and two pyrogenous acids,—one of which is crystalline, and is called *pyrotartaric acid* ($\mathrm{C^5H^3O^3+Aq.}$); the other is oily, and is termed *pyruvic acid* ($\mathrm{C^6H^3O^5+Aq.}$) Strongly heated in the air it evolves the odour of caramel, and furnishes a carbonaceous mass, which eventually disappears by combustion. Fifteen parts of cold water dissolve ten parts of crystallised tartaric acid: boiling water takes twice its own weight of the acid. A soft, mucilaginous, flexible mass is formed in a solution of tartaric acid, as well as of emetic tartar, when long kept.[1] Alcohol sparingly dissolves the acid. Heated with either nitric acid or potash it yields oxalic acid. By the action of sulphuric acid on it, acetic acid is formed. When heated with sulphuric acid it is strongly blackened.

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[1] Brooke, *Annals of Philosophy*, new series, vol. vi. p. 118.

[2] See Fremy, *An. de Chim. et de Phys.* Août 1838.

CHARACTERISTICS.—A solution of tartaric acid is very sour, and causes, with solutions of caustic lime, baryta, and strontia, white precipitates (*earthy tartrates*), soluble in excess of acid. Sal ammoniac dissolves the precipitate (*tartrate of lime*) produced by lime water. With acetate of lead the solution of tartaric acid also forms a white precipitate (*tartrate of lead*) soluble in excess of nitric acid. Dropped into a solution of sulphate of lime it furnishes no precipitate. Heated with a solution of chloride of platinum, tartrate of potash occasions a black precipitate (*metallic platinum*). If excess of acid be added to a concentrated solution of a potash salt, small granular crystals (*bitartrate of potash*) are deposited. With nitrate of silver, tartrate of potash furnishes a white precipitate (*tartrate of silver*), which, when heated, does not deflagrate, but becomes brown, froths up, evolves white fumes, and leaves pure silver.

The London College gives the following directions for ascertaining the purity of tartaric acid:—

> Free from colour; destroyed by a red heat; soluble in water. The solution precipitates bitartrate of potassa from any neutral salt of potassa. Nothing is precipitated from the same solution by the chloride of barium. That which acetate of lead precipitates is soluble in nitric acid. One hundred grains of this acid dissolved in water are saturated by 192 grains of crystals of carbonate of soda.

COMPOSITION.—The composition of tartaric acid is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*
Carbon	4	24	36·36	35·980
Hydrogen	2	2	3·03	3·807
Oxygen	5	40	60·61	60·213
Anhydrous Tartaric Acid	1	66	100·00	100·000

	At.	*E. Wt.*	*Per Ct.*
Anhydrous tartaric acid	1	66	88
Water	1	9	12
Crystallised Tartaric Acid	1	75	100

or, $C^4H^2O^5$—Symbol $\overline{T}$; or, $C^4H^2O^5 + HO$.

Liebig regards the equivalent weight of the acid as double that above assumed; and the acid, therefore, is considered as a bibasic one, inasmuch as, on this hypothesis, it saturates two equivalents of base. [According to Liebig, therefore, the formula of the crystallised acid is $C^8H^4O^{10} + 2HO$, and of the acid in the bibasic salts, $C^8H^4O^{10} = \overline{T}$.—ED.] Fremy's researches, above referred to, tend to support this view.

IMPURITY.—The only adulteration practised on this acid is the mixture of its powder with bitartrate of potash. This fraud may be detected by the difficult solubility in water of the bitartrate, and its yielding, on incineration, carbonate of potash (known by the usual tests). The tests of the purity of the acid, given by the Edinburgh College, are as follows:—

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[1] This formation is probably owing to the development in the solution of a vegetable organised being. Keitzing (*Repertoire de Chimie*, iii. 278, Paris, 1838) has described and figured the plant which forms in a solution of emetic tartar.

"When incinerated with the aid of the red oxide of mercury, it leaves no residuum, or a mere trace only."—*Ph. Ed.*

This test is devised to detect any fixed substance, and might be used to recognise the potash, if bitartrate of this alkali had been present.

PHYSIOLOGICAL EFFECTS.—The effects of tartaric acid, *in small doses* properly diluted, are those of a refrigerant. It reduces febrile heat, diminishes excessive vascular action, allays thirst, checks excessive perspiration, and perhaps also a too copious secretion of bile. It appears to promote the action of the absorbents, to increase the secretion of urine, and to act gently on the bowels. It possesses the tonic properties of the mineral acids in a very slight degree only, if at all. Its continued use very readily disturbs the digestive process. Some doubt exists as to the effect of *large doses* of the acid. According to Dr. Christison[1] it may be taken in very considerable quantities without injury. Six drachms have been taken in twenty-four hours without inconvenience. Pommer, however, asserts that when it is injected into the veins it is scarcely less poisonous than oxalic acid (*Ibid.*) [One ounce of the acid taken at a dose, dissolved in half a pint of warm water, produced violent inflammation of the alimentary canal, and death in nine days.—ED.]

USES.—Tartaric acid may be used as a cheap substitute for citric acid or lemon juice, in the formation of acidulous refrigerant drinks, for febrile and inflammatory disorders. It is, however, rarely employed for this purpose. Its common medicinal use is in the preparation of effervescing compounds, with the alkaline carbonates, especially with bicarbonate of soda.

EFFERVESCING TARTRATES.—The following are the relative proportions of tartaric acid and alkaline carbonates for preparing effervescing draughts:—

20 grains of the Crystals of Tartaric Acid are saturated by—

Crystallised Bicarbonate of Potash	27 grs.
Carbonate of Potash of Commerce	22 „
Hydrated Sesquicarbonate of Ammonia	15½ „
Crystallised Carbonate of Soda	38½ „
Bicarbonate of Soda of Commerce	22 „

The most commonly used effervescing tartrate is that made with Bicarbonate of soda (see *Sodæ Bicarbonas* and *Sodæ Tartras*).

[*Baking Powders.*—Tartaric acid is largely consumed in the manufacture of the various kinds of baking powders. We subjoin a good formula:—Powdered Tartaric Acid, ℥iv.; Powdered Bicarbonate of Soda, ℥v.; Finely Powdered Rice Flour, ℥iss. Mix.—ED.]

3. **TROCHISCI ACIDI TARTARICI**, E.; *Acidulated Lemon Lozenges* or *Acidulated Drops.* (Tartaric Acid, ʒij.; Pure Sugar, ℥viij.; Volatile Oil of Lemons, ♏x. Pulverise the sugar and acid, add the oil, mix them thoroughly, and with mucilage beat them into a proper mass for making lozenges.—Employed for coughs and sore throats. More commonly taken, on account of their agreeable flavour, as articles of confectionary.

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[1] *Treatise on Poisons*, 3d edit. p. 208.

311. VINUM.—WINE.

THE necessarily confined limits of this work compel me to devote a smaller space to the consideration of wine than its interest and importance otherwise demand. In the British pharmacopœias the only officinal wine directed to be used is *Sherry* (*Vinum Xericum*, L.; *Vinum Album; Sherry*, E.; *Vinum album Hispanicum*, D.) For medicinal purposes, however, other wines are also used; so that it is necessary to take a general view of the properties of wines.

The *manufacture* of wine deserves a passing notice. Grape juice does not ferment in the grape itself. This is owing, not, as Fabroni[1] supposed, to the gluten being contained in distinct cells to those in which the saccharine juice is lodged, but to the exclusion of atmospheric oxygen, the contact of which, Guy-Lussac[2] has shown, is necessary to effect some change in the gluten, whereby it is enabled to set up the process of fermentation. The expressed juice of the grape, called *must* (*mustum*), whose composition has been already stated, readily undergoes the vinous fermentation when subjected to a temperature of between 60° and 80° F. It becomes thick, muddy, and warm, and evolves carbonic acid gas. After a few days this process ceases; the thick part subsides, the liquid becomes clear, and is then found to have lost its sweet taste, and to have become vinous. I have already explained the theory of the process, and also made some remarks respecting yeast. The wine is now drawn off into casks, where it undergoes further changes. It is then racked off into other casks, where it is subjected to the operation of *sulphuring* (*i. e.* exposed to sulphureous acid, either by burning sulphur matches in the cask, or by the addition of wine impregnated with this acid), to render the glutinous matter incapable of re-exciting fermentation. After this, the wine is usually clarified, or *fined* (*i. e.* deprived of those matters which render the wine turbid, and dispose it to undergo deteriorating changes). Isinglass or white of egg (*i. e.* gelatine or albumen) is commonly employed for this purpose. The first forms with the tannic acid—the second with the alcohol, reticulated coagula, which envelop and carry down the solid particles that endanger the safety of the wine.[3]

The peculiar qualities of the different kinds of wine depend on several circumstances; such as the variety and place of growth of the vine from which the wine is prepared,—the time of year when the vintage is collected,—the preparation of the grapes previously to their being trodden and pressed,—and the various manipulations and processes adopted in their fermentation. The wines of different countries are distinguished in commerce by various names. The following is a list of the wines most commonly met with, arranged according to the countries producing them:

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[1] *De l'Art de faire le Vin*, Paris, 1801.

[2] *Ann. de Chim.* lxxvi. 245.

[3] For further details, consult Fabroni, *De l'Art de faire le Vin*, traduit de l'Italien par F. R. Baud, Paris, 1801; Chaptal, *L'Art de faire le Vin*, 2e édit. Paris, 1819: also *Ann. de Chim.* t. xxxv. xxxvi. xxxvii.; Dr. Macculloch, *Remarks on the Art of Making Wine*, 1816; and Busby's *Journal*, before quoted.

1. **FRENCH WINES.**—*Champagne* (of which we have the *still*, *creaming*, or *slightly sparkling*,—the *full frothing*,—the *white*—and the *pink*); *Burgundy* (*red* and *white*); *Hermitage*; *Côte Rôtie*; *Rousillon*; *Frontignac*; *Claret* (the most esteemed being the produce of *Lafitte*, *Latour*, *Château Margaux*, and *Haut-Brion*); *Vin de Grave*; *Sauterne*, and *Barsac*.
2. **SPANISH WINES.**—*Sherry* (Xeres); *Tent* (Rota); *Mountain* (Malaga); *Benicarlo* (Alicant).
3. **PORTUGAL WINES.**—*Port*, *red* and *white* (Oporto); *Bucellas*, *Lisbon*, *Calcavella*, and *Colares* (Lisbon). An inferior description of red Port Wine is shipped at Figuera and Aveiro.
4. **GERMAN WINES.**—*Rhine* and *Moselle Wines*. The term *Hock* (a corruption of *Hockheimer*) is usually applied to the first growths of the Rhine. The term *Rhenish* commonly indicates an inferior Rhine Wine.
5. **HUNGARIAN WINES.**—*Tokay*.
6. **ITALIAN AND SICILIAN WINES.**—*Lachryma Christi*; *Marsala*; *Syracuse*; *Lissa*.
7. **GRECIAN AND IONIAN WINES.**—*Canadian* and *Cyprus* wines.
8. **WINES OF MADEIRA AND THE CANARY ISLANDS.**—*Madeira* and *Canary* (Teneriffe).
9. **WINES OF THE CAPE OF GOOD HOPE.**—*Cape Madeira*, *Pontac*, *Constantia red* and *white* (a sweet, luscious wine, much esteemed).
10. **PERSIAN WINES.**—*Shiraz*.
11. **ENGLISH WINES.**—*Grape*, *Raisin*, *Currant*, *Gooseberry*, *&c.*

Wines are also designated, according to their colour, *red* or *white*; according to their taste and other properties, *sweet*, *acidulous*, *dry*, *strong* or *generous*, *light*, *rough*, *sparkling*, &c.

The *constituents* of wine are, according to Gmelin,[2] as follows:—*Alcohol*, *an odorous principle* (volatile oil?) *blue colouring of the husk* (in red wine), *tannin*, *bitter extractive*, *grape sugar* (especially in the sweet wines), *gum*, *yeast*, *acetic acid* (from the commencement of the acetous fermentation), *malic acid*, *tartaric acid*, *bitartrate of potash*, *bitartrate of lime*, *sulphates* and *chlorides*, *phosphate of lime*, *carbonic acid* (especially in the effervescing wines) and *water*. To these may be added, in some of the Rhine wines, *paratartaric* or *racemic acid*.

1. **ŒNANTHIC ETHER.** *Bouquet of Wine: Odoriferous Principle of Wine.*—Every wine has a peculiar odour, which depends, doubtless, on a small quantity of volatile oil. The oil obtained from corn and potato spirit will be hereafter noticed. Liebig and Pelouze[2] have examined the oily liquid procured in the distillation of wine as well as by submitting wine lees to distillation, and found it to be *œnanthic ether* ($C^{18}H^{18}O^{3}$) mixed with *œnanthic acid* ($C^{14}H^{13}O^{2}$). From 22,000 lbs. (about 2200 imperial gallons) only two lbs. and one-fifth of oily liquid were procured.

[Œnanthic ether is, therefore, an œnanthate of oxide of ethyle: for—

$$\underbrace{C_{18}H_{18}O_{3}}_{\text{Œnanthic Ether.}} \quad = \quad \underbrace{C_{14}H_{13}O_{2}}_{\text{Œnanthic Acid.}} \quad + \quad \underbrace{C_{4}H_{5}O}_{\text{Ether.}}$$

This product of fermentation is the cause of the peculiar odour of wine which adheres so strongly to all vessels in which wine has been kept. It is obtained pure by distilling the oily product obtained from large quantities of wine with carbonate of soda. This combines with the free acid without affecting the ether. Chloride of calcium will subsequently remove any trace of water or alcohol.

PROPERTIES.—This ether is colourless and remarkably fluid. It has a powerfully vinous odour—almost intoxicating when much of the vapour is breathed at once. It has a strong, disagreeable taste. It is not perceptibly dissolved by water, but is easily taken up by alcohol and ether. Its specific gravity is 0·862, and its volatility is very slight, owing to its boiling-point being so high; according to Dumas, this is between

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[1] *Handb. d. Chem.* ii. 1255.

[2] *Ann. de Chim. et de Phys.* lxii. 438.

437° and 446°. Hence the persistence of the odour in vessels which have contained wine.—ED.]

2. ALCOHOL.—Mr. Brande[1] has shown that alcohol exists ready formed in wine. He also ascertained the quantity of this substance which exists in different wines. The latter point has also been examined by several other chemists; as Geiger,[2] Julia-Fontenelle,[3] Prout,[4] and Ziz,[5] and more recently by Dr. Christison.[6] Buris has ascertained the alcoholic strength of the wines of the Pyrénées-Orientales. Wines which contain a comparatively small quantity of spirit are denominated *light wines;* while those which have a much larger quantity are denominated *strong* or *generous wines.*[7]

Table of the proportion of Alcohol (sp. gr. 0·825 at 60° F.) *by measure, contained in* 100 *parts of Wine.* (*A.* means average; *F.* Fontenelle; *P.* Prout.)

	Brande.	*Others.*		*Brande.*	*Others.*
1. Lissa	*A.* 25·41	15·90 *P.*	24. White Hermitage	17·43	
2. Raisin	*A.* 25·12		25. Rousillon	*A.* 18·13	
3. Marsala	*A.* 25·09	18·40 *P.*	26. Claret	*A.* 15·10	
4. Port	*A.* 22·96	20·64 *P.*	27. Zante	17·05	
5. Madeira	*A.* 22·27	21·20 *P.*	28. Malmsey-Madeira	16·40	
6. Currant	20·55		29. Lunel	15·52	18·01 *F.*
7. Sherry	*A.* 19·17	23·80 *P.*	30. Shiraz	15·52	
8. Teneriffe	19·79		31. Syracuse	15·28	30·00 *P.*
9. Colares	19·75		32. Santerne	14·22	
10. Lachryma Christi	19·70		33. Burgundy	*A.* 14·57	12·16 *P.*
11. Constantia, white	19·75	14·50 *P.*	34. Hock	*A.* 12·08	
12. Constantia, red	18·92		35. Nice	14·63	
13. Lisbon	18·94		36. Barsac	13·86	
14. Malaga	18·94		37. Tent	13·30	12·20 *F.*
15. Bucellas	18·49		38. Champagne	*A.* 12·61	
16. Red Madeira	*A.* 20·35		39. Red Hermitage	12·32	
17. Cape Muschat	18·25		40. Vin de Grave	13·94	
18. Cape Madeira	*A.* 20·51		41. Frontignal(Rivesalte)	12·79	
19. Grape Wine	18·11		42. Côte Rôte	12·32	
20. Calcavella	*A.* 18·65		43. Gooseberry	11·84	
21. Vidonia	19·25		44. Orange	*A.* 11·26	
22. Alba Flora	17·26		45. Tokay	9·88	
23. Malago	17·26		46. Elder	8·79	

According to the more recent experiments of Dr. Christison, the quantity of alcohol in wines has been somewhat overrated. The following are his results:—

		Alcohol (0·7999) *per cent. by weight.*	*Proof Spirit per cent. by volume.*
Port	Weakest	14·97	30·56
	Mean of 7 wines	16·20	33·91
	Strongest	17·10	37·27
	White	14·97	31·31
Sherry	Weakest	13·98	30·84
	Mean of 13 wines, excluding those very long kept in cask	15·37	33·59
	Strongest	16·17	35·12
	Mean of 9 wines very long kept in cask in the East Indies	14·72	32·30
	Madre da Xeres	16·90	37·06
Madeira—All long in cask in East Indies	Strongest	16·90	36·81
	Weakest	14·09	30·86

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[1] *Phil. Trans.* for 1811, p. 337; and for 1813, p. 82.

[2] Gmelin, *Handb. d. Chem.* ii. 1256.

[3] *Journ. de Chim. Méd.* iii. 332.

[4] Henderson, *op. cit.* p. 363.

[5] Jameson's *Journal.*

[6] *Journ. de Chim. Méd.* 2e sér. t. v. p. 502.

[7] For further details respecting wines, the reader is referred to the works of Barry and Henderson already quoted, and to *The Topography of all the known Vineyards,* English translation, 1824; Redding's *History of Modern Wines,* 1833; and Busby's *Visit to the Vineyards of Spain and France,* London, 1834.

	Alcohol (0·7999) *per cent. by weight.*	*Proof Spirit per cent. by volume.*
Teneriffe, long in cask at Calcutta	13·84	30·21
Cercial	15·45	33·65
Dry Lisbon	16·14	34·71
Shiraz	12·95	28·30
Amontillado	12·63	27·60
Claret, a first growth of 1811	7·72	16·95
Chateau-Latour, first growth 1825	7·78	17·06
Rosan, second growth 1825	7·61	16·74
Ordinary Claret, a superior "vin ordinaire"	8·99	18·96
Rivesaltes	9·31	22·35
Malmsey	12·86	28·37
Rüdesheimer, superior quality	8·40	18·44
Ditto inferior quality	6·90	15·19
Hambacher, superior quality	7·35	16·15

Dr. Christison states that by keeping wines, as Sherry and Madeira, in casks, for a moderate term of years, the quantity of alcohol increases; but after a certain time it decreases; and it is probable that at the period when wines begin to lose alcohol they cease to improve in flavour.

3. FREE ACIDS.—All wines are more or less acidulous, as determined by litmus. They owe this property principally to malic acid, but in part also to citric and tartaric acids. The Rhenish and Moselle wines and claret are termed *acid wines.* The brisk, frothing, sparkling, or *effervescent wines* (as Champagne), which are bottled before fermentation is complete, owe their peculiar properties to the retention, and subsequent escape when the confining force is removed, of the developed carbonic acid gas. They are apt to become *ropy,*—a change which is prevented by pure tannic acid or powdered nutgalls. The tannic acid of some wines, especially the red wines (as Port), is derived, in great part, from the husk of the grape, but partly, perhaps, from the seeds. It gives to these wines their astringency, and power of becoming dark-coloured with the ferruginous salts.

4. SUGAR.—This constituent varies considerably in quantity in different wines. Those in which it is abundant are denominated *sweet wines,* as Tokay, Tent, and Frontignac.

5. EXTRACTIVE.—Exists in all wines, but diminishes (by deposition) with their age.

6. COLOURING MATTER.—All wines contain more or less colouring matter. When grape juice, without the husks of the fruit, is fermented, the wine is pale, and is denominated *white wine;* but if the husk be present during fermentation, the wine is deep-coloured, and is usually called *red wine.* Except in the *tintilla* or *teinturier* grape, the purple colouring matter resides in the husk, and is dissolved in the newly-formed alcohol, and is reddened by the free acid. In the exception just mentioned, the colouring matter is diffused through the pulp. According to Nees von Esenbeck, the purple colouring matter of the grape resides on the inner side of the husk (epicarp). By exposure to the sun, as well as by age, the colour of wines is diminished; the colouring matter being precipitated. It may be artificially removed by milk, lime-water, charcoal, or diacetate of lead.

7. TARTAR (*Bitartrate of Potash*).—The most important saline constituent of wine is tartar. It is deposited along with colouring and extractive matters, both in the cask and bottle constituting *argol* and the *crust.* The deposition increases with the formation of alcohol, owing to its insolubility in this liquid. Red wines (especially the youngest, roughest, and most coloured) contain more than white wines.

ADULTERATION.—Various impositions are said to be practised by dealers on the consumers of wines. These are almost entirely confined to the mixing of wines of various qualities. In some cases, however, the finest wines have been prepared by mixture. "From the gradual mixture of wines of various ages," observes Mr. Busby,[1] "no wine can be further from what may be called a *natural wine* than sherry."

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[1] *Op. supra cit.* p. 3.

In some cases inferior kinds of wine are substituted by fraudulent dealers for finer ones.

To augment the strength of wine, brandy is frequently added. This is done to sherry before it is shipped from Spain. To good wines, however, it is never added in greater quantities than four or five per cent.[1] By recent regulations, ten per cent. of brandy may be added to wines after their arrival in this country, and while in the bonded vaults; the increased quantity only paying the wine duty.

Colouring matters are also employed to deepen or change the tint of wine. In Spain, *boiled must* (of the consistence of treacle, and having a similar flavour, but with a strong empyreumatic taste) is employed to deepen the colour of sherry. It is prepared by boiling down must to a fifth part of its original bulk.[2] In this country, caramel is said to be used for a similar purpose. In Portugal the juice of the elderberry has been employed to augment the colour of Port-wine, the produce of poor vintages. To such an extent was this, at one time, practised, that the Wine Company of Portugal rooted out the trees, and prohibited their growth in the wine district. Flavouring substances are also occasionally added to wines. Thus in Spain, *Amontillado* or *Montillado* (a very dry kind of sherry) is added to sherries which are deficient in the nutty flavour. Being very light in colour, it is also used to reduce the colour of sherries which are too high. Kino and logwood are said to be used in this country to augment the astringent flavour and deepen the colour of Port-wine.

Lead, formerly used to sweeten wine,[3] may be occasionally detected, in very minute quantity, in wine (by sulphuretted hydrogen). It is usually to be traced to shot in the bottle, and rarely to fraud.[4]

EFFECTS.—The *physiological effects* of wine next deserve our attention. Taken in moderate quantities, wine operates as a stimulant to the nervous and vascular systems, and the secreting organs. It quickens the action of the heart and arteries, diffuses an agreeable warmth over the body, promotes the different secretions, communicates a feeling of increased muscular force, excites the mental powers, and banishes unpleasant ideas. In a state of perfect health, its use can be in no way beneficial, but, on the contrary, its habitual employment in many cases proves injurious, by exhausting the vital powers, and inducing disease. The actual amount of injury it may inflict will of course vary with the quantity and quality of the wine taken, and according to the greater or less predisposition to disease which may exist in the system. Maladies of the digestive organs, and of the cerebro-spinal system, gout and dropsy, are those most likely to be induced or aggravated by it. Intoxication in its varied forms is the effect of excessive quantities of wine. It is remarkable, however, that though the effects of wine mainly depend on the alcohol contained in this liquor, yet they differ in several circumstances from those of the latter. In the first place, wine possesses a tonic influence not observed after the use of ardent spirit. Common experience proves to every one, that the stimulant influence communicated by wine is slower in its production and subsidence than that developed by spirit. In the second place, the intoxicating influence of wine is not equal to that of mixtures of ardent spirit and water of corresponding strengths, nor proportionate in different wines, to the relative quantities of alcohol which they contain. This will be obvious from the following table, drawn up from Mr. Brande's results, before quoted:—

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[1] Busby, *Op. supra cit.* p. 4.

[2] *Ibid.* pp. 4 and 11.

[3] See Beckmann, *Hist. of Invent.* i. 396.

[4] See a case in the *Phil. Mag.* liv. 229.

Average quantities of Ardent Spirit and of Wine, containing four fluidounces of Alcohol (sp. gr. 0·825 at 60° F.)

Brandy, about	8	fluidounces.
Port Wine	18½	ditto.
Claret	26½	ditto.
Champagne	32	ditto.

Now it is obvious from this table that if the intoxicating power of vinous liquids was in proportion to the spirit contained in them, that a pint of Port-wine would be almost equal to half a pint of brandy, and that Claret would exceed Champagne in its influence over the nervous system; all of which we know not to be the case. It is therefore obvious, that the other constituents of the wine possess the power of modifying the influence of the alcohol. Furthermore, it is probable that they are enabled to do this by being in chemical combination with the spirit; for it is asserted by connoisseurs, that a brandied wine (*i. e.* wine to which brandy has been added) is more intoxicating than a non-brandied wine equally strong in alcohol. Hence dealers endeavour to obviate this by the operation of *fretting in*, and which, in a scientific point of view, may be regarded as effecting the chemical combination of the foreign spirit with the constituents of the wine, by a second or renewed fermentation. A third distinction between the operation of wine and ardent spirit is the greater tendency of the latter to induce disease of the liver. "It is well known," observes Dr. Macculloch,[1] "that diseases of the liver are the most common, and the most formidable, of those produced by the use of ardent spirits; it is equally certain that no such disorders follow the intemperate use of pure wine, however long indulged in. To the concealed and unwitting consumption of spirit, therefore, as contained in the wines commonly drunk in this country, is to be attributed the excessive prevalence of those hepatic affections which are comparatively little known to our continental neighbours."

USES.—The *uses* of wine are threefold—dietetical, medicinal, and pharmaceutical. To persons in health, the *dietetical* employment of wine is either useless or pernicious. The least injurious are the light wines, especially Claret. As a *medicinal* agent, wine is employed principally as a cordial, stimulant, and tonic; but some of the wines possess astringent and acid properties, for which they are occasionally resorted to. In the latter stages of fever, when languor and torpor have succeeded to a previous state of violent action, and in the low forms of this disease, wine is at times undoubtedly useful. It supports the vital powers, and often relieves delirium and subsultus tendinum, and promotes sleep.

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[1] *Op. cit.*

But it is much less frequently and copiously employed than formerly. As a stimulating tonic and invigorating agent, it is given in the state of convalescence from fever, and from various chronic non-febrile diseases. In extensive ulceration, copious suppuration, gangrene of the extremities, and after extensive injuries or severe operations, or profuse hemorrhages, when the powers of life appear to be failing, wine is administered often with the best effects. It has been liberally employed in tetanus, and at times with apparent alleviation of the disease. If in any of the preceding cases it causes dryness of the tongue, thirst, quick pulse, restlessness, or delirium, it should of course be immediately laid aside. And it is obvious that in acute inflammation, especially of the brain or thoracic organs, in tendency to sanguineous apoplexy, and in the first or acute stage of fever, the employment of wine is objectionable, and calculated to prove highly injurious.

1. PORT WINE (*Vinum Lusitanicum* seu *Portugallicum*) is applied to most of the purposes above mentioned for which a stimulant and tonic is required, and is the wine ordinarily employed in the public hospitals of this metropolis. On account of its astringency, it is particularly useful in those cases which are attended with a relaxed condition of the bowels; but it is apt to disagree with weak stomachs. A mixture of two-thirds Port wine and one-third water is used as an injection for the radical cure of hydrocele.

2. BURGUNDY (*Vinum Burgundicum*) is a stimulant, and somewhat astringent wine; but is rarely used in this country for medicinal purposes.

3. SHERRY (*Vinum Xericum*, Ph. L.; *Vinum album*, Ph. Ed.; *Vinum album Hispanicum*. Ph. D.) is peculiarly valuable, on account of the small quantity of free acid which it contains; and it is, therefore, the wine best adapted for patients troubled with gout, or having acidity of stomach, or a deposition of lithic acid in the urine.

4. MADEIRA (*Vinum Maderaicum*) is a more stimulating wine than Sherry, and is, therefore, better adapted for old persons and debilitated broken-down constitutions, where its slight acidity is not objectionable. It is an excellent wine for invalids.

5. CHAMPAGNE (*Vinum Campanicum*) is a diuretic and a speedy intoxicator. It excites lively and agreeable feelings, and, in consequence, is adapted for hypochondriacal cases. On account of the evolution of carbonic acid, it may be occasionally employed to allay vomiting.

6. The RHINE WINES (*Vinum Rhenanum*), of which *Hock* (*Vinum Hochheimense*) is the most familiar example, and the *Moselle wine* (*Vinum Mosellanum*), are refrigerant and light wines. They prove diuretic and slightly aperient. Their acidity adapts them for use where phosphatic sediments are observed in the urine. They are used also in low fever, with at least less likelihood of doing harm than the stronger wines.

7. CLARET (*Vinum rubellum*) has been already mentioned as one of the least injurious of wines. It is adapted for the same cases as the Rhine and Moselle wines. Both are, of course, objectionable in gouty cases and lithic acid deposits, on account of their acidity.

As a *pharmaceutical agent*, wine is employed for the preparation of the *medicated wines* (*vina medicata*). *Sherry* is the kind employed by the British colleges; but for economy druggists often use Cape wine. Its efficacy resides essentially in the alcohol which it contains. In some cases, however, its acidity may increase its solvent power. But as the quantity of alcohol which it contains is variable, and as it is more liable to undergo decomposition than a tincture containing the same proportion of spirit, the medicated wines are objectionable preparations.

5. SPIRITUS VINI GALLICI, L.—See *post.*

6. MISTURA SPIRITUS VINI GALLICI, L.—See *post.*

ALCOHOL AND ITS PRODUCTS.

312. ALCOHOL, *L. E. D.*

HISTORY.—Fermented liquors were known in the most remote ages of antiquity. The Sacred historian tells us,[1] that, after the flood (which is supposed to have occurred 2348 years before Christ), "Noah planted a vineyard: and he drank of the wine, and was drunken." Homer,[2] the most ancient of all the profane writers whose works have reached us, and who lived more than 900 years before the Christian era, also frequently mentions wine, and notices its effects on the body and mind. Herodotus,[3] who wrote 445 years before Christ, tells us that the Egyptians drank a liquor fermented from barley.

It is uncertain at what period vinous liquors were first submitted to distillation. Morewood[4] considers the Chinese to have been acquainted with this process long before the rest of Asia, Africa, and Europe. It is usually stated, that Albucasis, who is supposed to have lived in the 12th century, taught the mode of procuring spirit from wine.[5] But as the process of distillation was certainly known long before his time,[6] it is highly probable that his predecessors had submitted fermented liquors to this operation. Raymond Lully,[7] in the 13th century, was acquainted with spirit of wine (which he called *aqua ardens*), as well as with the mode of depriving it of water by means of carbonate of potash.

PREPARATION.—The preparation of alcohol may be divided into three stages: the production of a fermented vinous liquor; the preparation from this of an ardent spirit by distillation; and, lastly, rectification or purification.

[*Description of Improved Distilling Apparatus.*—This apparatus, of which an engraving is given at p. 434, is probably the best which has yet been invented for the manufacture of alcohol. It is now almost universally adopted in these kingdoms. It produces from the fermented wort, or wash, spirits of the highest strength and purity at one continuous operation, avoiding all occasion for redistilling or rectifying, and it is said to require less than one-fourth of the quantity of fuel which would be used with common stills. Some of these apparatus are of enormous magnitude, producing as much as 1000 gallons of spirits per hour.

The construction of the apparatus and its principles of action will be readily understood with the assistance of the drawing.

The body of the apparatus consists of two distillatory columns ABCD and EFGH, supplied with steam from an ordinary low pressure boiler. The column ABCD is called the *analyzer*, and is divided into numerous compartments by horizontal diaphragms of plate copper, each of which is perforated by very numerous holes of minute diameter to allow the steam from the boiler to pass upwards from one compartment to another; in each diaphragm, also, is inserted one or more light valves, which also open upwards whenever the steam is in such quantity as not to find a ready passage through the small pertorations; to each of them are also attached pipes by which the wash is allowed to flow downwards from plate to plate. The upper end of each of these pipes projects an inch above the plate or diaphragm in which

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[1] *Genesis*, ix.

[2] *Odyssey*, ix. and xxi.

[3] *Euterpe*, lxxvii.

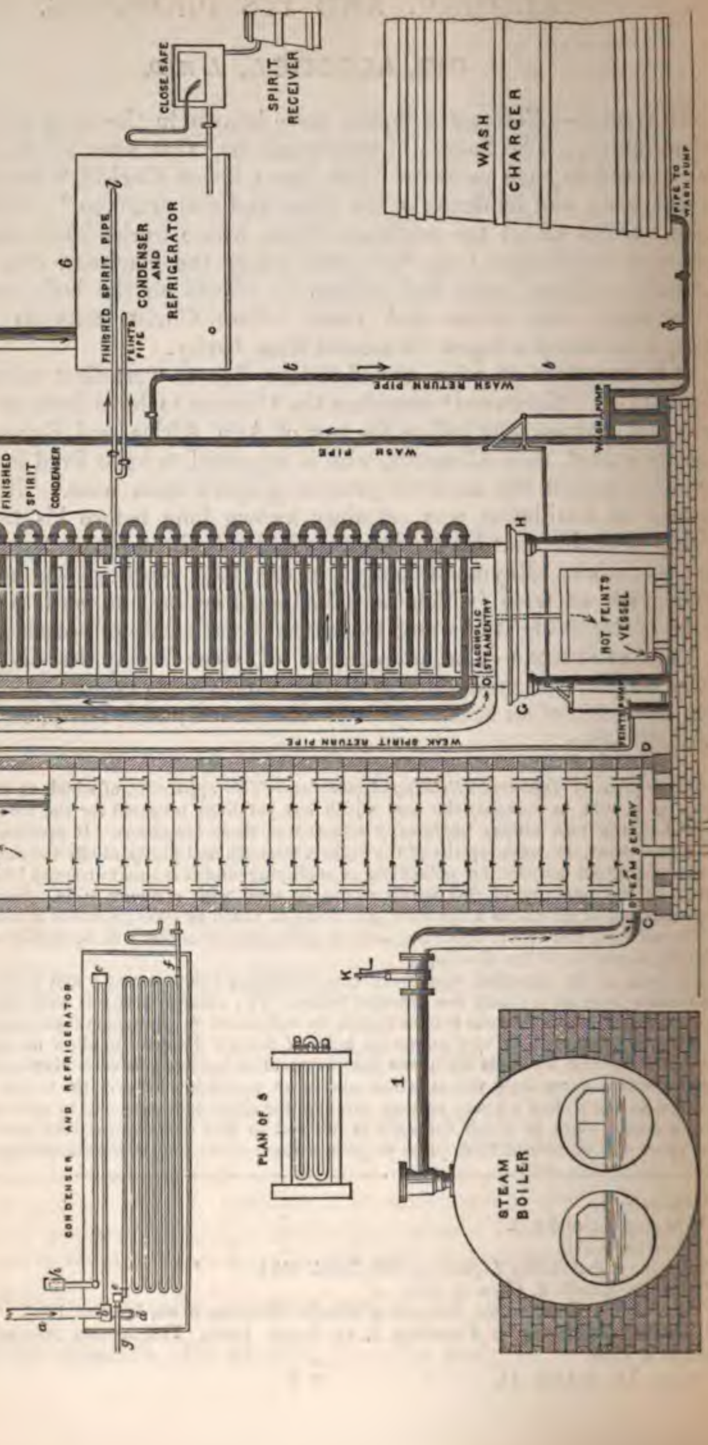
[4] *Essay on Inebriating Liquors*, p. 107, Lond. 1824.

[5] Gmelin, *Handb. d. Chem.* ii. 274.

[6] Dr. Royle's *Essay on the Antiquity of Hindoo Medicine*, p. 46, London, 1837.

[7] Thomson's *History of Chemistry*, i. 41, Lond. 1830; *Testamentum Novissimum*, edit. Basil, p. 2, 1600.

FIG. 81.



Improved Apparatus of Æneas Coffey and Sons, of Bromley, near Bow, for the Distillation of Spirit.

it is inserted, so as to retain at all times during the distillation a "*stratum*" of wash of that depth on each plate; the lower end of each pipe dips a little way into a shallow pan lying on the plate beneath, thus forming a "*trap*" by which the passage of steam upwards through the pipe is prevented; these pipes are inserted at alternate ends of the diaphragms, as shown in the drawing.

The column EFGH is divided, in a similar manner to that just described, into chambers by interposed copper plates or diaphragms; the lowermost twenty of these constitute the *rectifyer*, and its plates are perforated and furnished with valves and overflow-pipes like those of the analyzer. The upper chambers of the column form the *finished spirit condenser*, and are separated from the others by a diaphragm *without* small perforations or valves, but having a large opening for the passage upwards of the vapour, and an overflow-pipe; this pipe does not project at all above the surface of the diaphragm, and there is a neck or collar round the large vapour opening, which rises for an inch and prevents the descent of any liquid through that opening. Under the overflow-pipe of this plate there is a pan much deeper than the pans of the other overflow-pipes; and from this pan a pipe, furnished with a stop-cock, passes out of the apparatus and carries the condensed, but still very hot, spirits to the refrigerator to be cooled.

The diaphragms which separate the different chambers of this spirit condenser from each other are similar to that just described; that is to say, they have neither perforations nor valves, but they have openings at their alternate ends for the passage of the vapour upwards, and overflow-pipes for the passage of the spirit downwards, which pipes do not project above the plate; the use of these diaphragms being merely to cause the vapours to take a serpentine direction through the various chambers.

In every chamber of the column EFGH there is a serpentine coil of pipes, placed as shown in plan in the drawing; each of these coils is connected outside with those above and below, so that they thus form one continuous pipe leading from the wash-pump through all the various chambers of this column, from the lowest of which it passes out and, rising up, discharges itself on the highest diaphragm of the analyzer.

The wash-pump, which is worked continuously during the distillation, is so large as to be capable of furnishing more wash than is necessary, and its rising main is furnished with a branch pipe leading back to the suction and furnished with a stop-cock, by which part of what is pumped up may be allowed to run back and the supply to the apparatus thus regulated.

Mode of Action.—When commencing an operation, the wash-pump is first set to work to fill all the serpentine coils of pipe until the wash begins to flow into the analyzer. The *pump is then stopped*, and the steam admitted from the boiler into the bottom of the *analyzer*, and passing up through its different chambers, it issues from the top, and is conducted through the large pipe M into the bottom of the rectifier, through the various chambers of which it then rises, enveloping the coils of pipe and rapidly heating the wash contained in them.

When the attendant perceives (by feeling the connecting bends of the coils) that the heat is beginning to rise into the lower chambers of the finished spirit condenser, he again sets the pump to work, and thenceforth the operation becomes continuous — the wash, nearly boiling, flows in a constant stream into the uppermost chamber of the analyzer and thence passes downward, from chamber to chamber, through the overflow-pipes. It must be remembered that steam cannot pass up through these overflow-pipes, their lower ends being "trapped;" nor can the wash descend through the perforations or valves, as these openings *are only sufficient to afford a passage for the steam upwards under a slight pressure.* The wash, therefore, can only find its way downward through the overflow-pipes; and it is obvious that in its passage it is spread into strata as many times as there are diaphragms, and is thus exposed to the most searching action of the steam which is constantly blowing up through it and depriving it of its alcohol; by the time it reaches the lowest chamber it is completely denuded of spirit, and is discharged through the pipe S, which is in the form of an inverted syphon many feet deep, to prevent the escape of steam along with the wash. This syphon is not shown in the drawing.

Although the steam on issuing from the analyzer by the pipe M contains much alcohol, it is not yet strong or pure enough; but in passing through the chambers of the rectifier, where it envelopes the coils of pipe and heats the wash which is passing through them, it at the same time parts with its own more watery portions, which are condensed on the surface of the coils of pipe, and fall in a boiling state on the diaphragms of the rectifier. By the time the vapour reaches the finished spirit condenser it is perfectly *pure*;[1] and, as the wash in the coils of this part of the column is nearly cold, it condenses the whole of this vapour, which, assuming the form of boiling alcohol, is in that state drawn off to the refrigerator by the stop-cock mentioned above.

At the top of the spirit condenser is a large pipe which serves as a vent for the incondensable gases which are disengaged in the process; this pipe communicates with a condenser immersed in the vessel which contains the refrigerator, as shown in the drawing.

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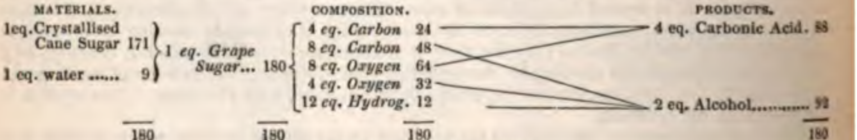
[1] Sp. Gravity, ·817.

The watery portions of the vapour which are condensed in the chambers of the rectifier descend through that column as the wash does in the analyzer; but as, on their reaching the bottom, they still contain a little spirit, they are conveyed thence to the hot feints vessel and thence pumped into the top of the analyzer, where they mix with the wash and, like it, are deprived entirely of spirit.—ED.]

STAGE 1. *PRODUCTION OF A VINOUS LIQUOR.*—When vegetable substances are placed in contact with air and moisture, they undergo that kind of decomposition which is denominated *fermentation*. The products of this process vary at different periods or stages; and on this depends the distinction into kinds or varieties of fermentation. Thus starchy liquids, under some circumstances, become saccharine; the process being termed the *saccharine* fermentation. Sugar dissolved in water, and mixed with nitrogenous matter (*ferment*), is converted into carbonic acid and alcohol; and to this process the name of *vinous* fermentation is applied. Under some circumstances, mannite, lactic acid and a syrupy mucilage, are formed by the action of the nitrogenous or albuminous principles of vegetable juices on the sugar: this change has been denominated the *viscous* or *mucilaginous* fermentation.[1] Vinous liquids are capable of generating acetic acid, and the process is denominated *acetous* fermentation. Lastly, most vegetable substances are converted into gases, and a substance called vegetable mould (*humus*), constituting the process termed the *putrefactive* fermentation.

To produce a vinous liquid, it is necessary that there be present sugar (or some substance capable of forming sugar, as starch), a certain quantity of water, and a ferment, usually yeast. Moreover, a certain temperature (the best is between 70° and 80° F.) is requisite.

Both grape and cane sugar yield alcohol by fermentation. It is highly probable, however, "that cane sugar, before it undergoes vinous fermentation, is converted into grape sugar by contact with the ferment; and that, consequently, it is grape sugar alone which yields alcohol and carbonic acid."[2] On this view, the one equivalent or 171 parts of crystallised cane sugar unite with one equivalent or 9 parts of water, to form one equivalent or 180 parts of anhydrous grape sugar, which, in the process of fermentation, are converted into four equivalents or 88 parts of carbonic acid, and two equivalents or 92 parts of alcohol.



$$[C_{12}O_{12}H_{12}=4CO_2+2\underbrace{C_4O_2H_6}]$$

Vinous fermentation, then, is the metamorphosis of sugar into alcohol and carbonic acid. But as the elements of the yeast or other ferment take no part in the transformation (that is, do not enter into combination with the elements of the sugar), some difficulty has been experienced in accounting for its agency in exciting fermentation. Two opinions are entertained respecting it: by some it is regarded as a putrefying substance, whose atoms are in continual motion, which they communicate to the constituents of the sugar, and thereby destroy its equilibrium;[1] by others[2] yeast is considered to consist essentially of seeds or sporules, whose vegetation is the immediate cause of the metamorphosis of the sugar. The liquid obtained by the vinous fermentation has received different names, according to the substance from which it is obtained. When procured from the expressed juices of fruits, as grapes, currants, or gooseberries, it is denominated *Wine* (*Vinum*); from a decoction of malt and hops, *Ale* or *Beer* (*Cervisia*);[3] and from a mixture of honey and water *Mead* (*Hydromeli*). Fermented infusions of barley (raw grain and malt), prepared by the distillers of this country for the production of ardent spirit, are technically denominated *Washes*.

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[1] Liebig, in Turner's *Elements of Chemistry*, 7th edit. p. 947, London, 1840.

[2] *Ibid.* p. 946.

The liquid obtained by vinous fermentation consists of *water*, *alcohol*, *colouring* and *extractive matters*, *œnanthic ether*, *volatile oil* (*e. g.* oil of potatoes, oil of grain, &c.), *various acids* and *salts*.

STAGE 2. *PRODUCTION OF ARDENT SPIRITS.*—By the distillation of a vinous liquid we obtain *Ardent Spirit* (*Spiritus Ardens*). When grape wine is employed, the spirit is called *Brandy* (*Spiritus Vini Gallici*, Ph. L.); when the vinous liquid is obtained by the fermentation of molasses or treacle, the spirit is termed *Rum* (*Spiritus Sacchari*); when the liquid is a fermented infusion of grain (*Wash*), the spirit is denominated *Corn Spirit* (*Spiritus Frumenti*); and when the vinous liquid is either a fermented infusion of rice or toddy (*Palm Wine*), the spirit is named *Arrack* (if from the former, it is termed *Spiritus Oryzæ*). The well-known liquors called *Gin*, *Hollands* or *Geneva*, and *Whiskey*, are corn spirits flavoured.

Ardent spirit, from whatever source obtained, consists of *water*, *alcohol*, *volatile oil*, and, frequently, *colouring matter*. The following are, according to Mr. Brande,[4] the average quantities of alcohol (sp. gr. 0·825 at 60° F.) in some kinds of ardent spirit:—

100 *parts* (*by measure*) *of*	*Alcohol* (*by measure*)	100 *parts* (*by measure*) *of*	*Alcohol* (*by measure*)
Brandy contain	55·39	Whiskey (Scotch) contain ...	54·32
Rum	53·68	Whiskey (Irish)	53·20
Gin	51·60		

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[1] The view above referred to is that entertained by Liebig; for full details of it I must refer to his work, entitled *Organic Chemistry, in its Application to Agriculture and Physiology*, edited by L. Playfair, Ph. D., Lond. 1840; and Turner's *Elements of Chemistry*, 7th ed. p. 944, 1840. Berzelius (*Journ. de Chimie Médicale*, t. iii. p. 425, 2de Série, 1837) ascribes decompositions of this kind, which are effected by the mere contact of one body with another, to a new force which he supposes to be called into action, and which he denominates *catalytic force* (from καταλύω, I loosen or dissolve).

[2] The Yeast Plant has been already described and figured in a former part of this work, to which the reader is referred (*See* Fermentum Cervisiæ, Pt. 1, vol. ii. p. 44.). For further details, consult the Memoirs of Schwann (Poggendorf's *Annalen der Physik*, Bd. xli. p. 184; *Pharmaceutisches Central-Blätt* für 1837, S. 547; and Meyen's *Report on the Progress of Vegetable Physiology during the year* 1837, Lond. 1839), Cagniard-Latour and Turpin (*Biblioth. Univ. de Genève*, Nov. 1838; and Jameson's *Edinb. New Phil. Journ.* vol. xxv.), Keitzing (*Répertoire de Chimie*, t. iii. Paris, 1838), Quevenne (*Journ. de Pharm.* t. xxiv.); and Turpin (*Mémoires de l'Académie Royale des Sciences de l'Institut*, t. xvii., Paris, 1840).

[3] See Pt. 1, vol. ii. p. 86.

[4] *Phil. Trans.* for 1811 and 1813.

Each variety of ardent spirit has an aroma peculiar to itself, which is characteristic of the substance from which it is produced. This depends on volatile oil.

When wash is distilled, the fluid that comes over is called *Singlings*, or *Low Wines*. It is concentrated or *doubled* by a second distillation, by which *Raw Corn Spirit* is obtained. Towards the end of the distillation the distilled product acquires an unpleasant odour and taste from the presence of volatile oil, and is called *Faints*. Raw corn spirit is sold by the distiller to the rectifier at 11 or 25 per cent. *over proof*, in the language of Sikes's hydrometer.

STAGE 3. *RECTIFICATION*.—The object of the rectifier is to deprive ardent spirit of its volatile oil and water.[1] This is effected by repeated distillations, and by the use of pearlash (carbonate of potash), which, by its powerful affinity for water, checks the rise of this fluid in distillation. In this way is procured the liquid called *Rectified Spirit* (*Spiritus Rectificatus*, L. E. D.), which is sold by the rectifier to the chemist or apothecary. [By Coffey's apparatus (p. 434.) distillation and rectification are rapidly performed in one process.—ED.]

PROPERTIES OF RECTIFIED SPIRIT.—The liquid sold by rectifiers as rectified spirit (*Alcohol Dilutum*, L.; *Spiritus Rectificatus*, E. D.) varies from 54 to 60, or even 64 *per cent. over proof*, in the language of Sikes's hydrometer. Hatters employ that at 54 or 56; varnish-makers that at 58 per cent. over proof. The London College fixes the sp. gr. at 0·838 at 62° F.; the Edinburgh College at 0·838, or under, at 60° F.; the Dublin College at 0·840.

Purity.—Rectified spirit, besides having the sp. gr. above mentioned, should be colourless, transparent, and not rendered turbid on the addition of water. "In taste and smell it resembles wine." (*Ph. L.*) Its freedom from other substances than alcohol and water is to be determined partly by the purity of its odour, by the absence of any acid or alkaline reaction, and by its easy and complete volatility. It is frequently contaminated with the *oil of corn spirit;* of the presence of which there are two tests, sulphuric acid and nitrate of silver. If colourless oil of vitriol be added to rectified spirit, it causes a red tinge if the oil be present. According to Vogel, nitrate of silver is a more delicate test for the oil; if it be mixed with spirit, and exposed to solar light, it becomes red if any oil be present, but undergoes no change of colour if the spirit be pure. The following are the directions of the Edinburgh College for the application of this test:—

> "Four fluidounces [of rectified spirit] treated with 25 minims of solution of nitrate of silver [*Ph. Ed.*], exposed to bright light for twenty-four hours, and then passed through a filter purified by weak nitric acid, so as to separate the black powder which is formed,—undergo no further change when exposed to light with more of the test.

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[1] [A process has been recently patented for separating fusel oil and similar impurities from alcohol. The alcohol at 85 or 90 per cent. is distilled over about 1½ per cent. of manganate of potash or soda dissolved in a small quantity of water. By this operation the amylic alcohol is converted into valerianic acid, and the other oils undergo a similar change, the acids produced remaining combined with the alkali liberated by the decomposition of the manganate, while the alcohol does not undergo conversion into acetic acid unless an excessive quantity of manganate is used, but it is distilled over pure and colourless. See *Pharmaceutical Journal*, vol. xvi. p. 330, December, 1856.—ED.]

The peculiar odour which spirit obtained from brandy or whiskey possesses, depends on a volatile oil, which "is best removed, on the small scale, by rectification with a little caustic potash (Göbel, Leibig), or by digesting the spirits with freshly-ignited pine charcoal."[1]

PROOF SPIRIT (*Spiritus tenuior*, L. E. D.)—The sp. gr. of proof spirit is fixed by law at 0·920. [The *London College* directs that it should be made by adding to every five pints of Rectified Spirit (Spiritus Rectificatus, or Alcohol Dilutum, sp. gr. 0·838) three pints of distilled water at a temperature of 60°. The *Edinburgh College* orders of Rectified Spirit (sp. gr. 0·838) ℥xxi. and of Distilled Water, ℥xij. or a sufficiency. The *Dublin College* orders of the Rectified Spirit (sp. gr. 0·840) seven pints, Distilled Water, four pints. Mix. The specific gravity is 0·920. This College prepares a stronger spirit, called *Spiritus Fortior,* by agitating eight ounces of carbonate of potash, dried at a low red heat, with half a gallon of Rectified Spirit, separating the upper stratum by decantation, and distilling the liquid thus separated in a chloride of zinc bath, with a Liebig's condenser, until the product amounts to seventy-two ounces. The specific gravity of the *Spiritus Fortior* is 0·818. It is an intermediate compound between Alcohol and Rectified Spirit.—ED.] The tests of the purity of *Proof Spirit* are the same as for Rectified Spirit.

[In the Pharmacopœa Norvegica three varieties of alcohol are introduced: 1. *Alcohol Rectificatissimum*, $\text{Alc}+\text{HO}$, of which the sp. gr. is 0·833, and in 100 parts by weight there are 83·64 of alcohol and 16·36 of water. This is equivalent to 90 per cent. by measure of anhydrous alcohol. 2. *Alcohol Rectificatum*, $\text{Alc}+4\text{HO}$, sp. gr. 0·901.; 100 parts contain by weight 56·10 alcohol, and 43·90 water; 100 measures contain 65 of anhydrous alcohol. 3. *Alcohol Tenue*, $\text{Alc}+7\text{HO}$, sp. gr. 0·934. It contains by weight 42·20 of alcohol, and 57·80 of water; 100 measures contain 50 of anhydrous alcohol.—ED.]

PREPARATION OF ALCOHOL.—*Alcohol* (E. D.) is prepared by the chemist from the rectified spirit purchased of the rectifier. It is obtained by adding chloride of calcium, carbonate of potash, or well-burnt lime, to the spirit, which is then submitted to distillation. The salts or lime retain the water, while the alcohol distils over. The Pharmacopœia of the *London College* contains no process for the preparation of alcohol.

The *Edinburgh College* directs "Rectified Spirit, Oj.; Lime well burnt, ℥xviij. Break down the lime into small fragments: expose the spirit and lime together to a gentle heat in a glass matrass till the lime begins to slake: withdraw the heat till the slaking is finished, preserving the upper part of the matrass cool with damp cloths. Then attach a proper refrigeratory, and, with a gradually-increasing heat, distil off seventeen fluidounces. The density of this alcohol should not exceed 0·796: if higher, the distillation must have been begun before the slaking of the lime was finished.

The *Dublin College* takes of Spirit rectified by Carbonate of Potash (*Spiritus Fortior*), of a sp. gr. 0·818, Oj.; Pulverised fresh burnt Lime, ℥x. This mixture is to be distilled by means of a chloride of zinc bath until a product of nearly ℥xvj., of a sp. gr. 0·795, is procured. The first two ounces are to be rejected.

PROPERTIES OF ALCOHOL.—Alcohol is a limpid, colourless, inflammable liquid, having a peculiar and penetrating odour, and a burning taste. Its sp. gr. at 60° F. is 0·7947; at 68° F. it is 0·792—0·791. It is obvious, therefore, that the *Alcohol* of the *Edinburgh* and *Dublin* Colleges is a mixture of alcohol properly so called and water. No means of solidifying it are at present known. [It has been exposed by Faraday to a cold of —166°, by means of a bath of solid carbonic acid and ether. It acquired the consistency of castor oil, but did not solidify.—ED.] It boils at 172° F.: every volume of the boiling liquid gives 488·3 volumes of vapour, calculated at 212° F. It is very combustible. In atmospheric air it burns with a pale blue flame, giving out a very intense heat, and generating carbonic acid and water, but depositing no carbon, unless the supply of oxygen be deficient. The colour of the flame may be variously tinted—as yellow by chloride of sodium, whitish violet by chloride of potassium, green by boracic acid or a cupreous salt, carmine red by chloride of lithium, crimson by chloride of strontium, and greenish yellow by chloride of barium.

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[1] Turner's *Elements of Chemistry*, p. 829, 7th edit. Lond. 1840.

Alcohol has a strong affinity for water: hence it abstracts this fluid from the atmosphere, and precipitates from their watery solutions those salts (*e. g.* sulphate of potash) which are not soluble in spirit: while on the other hand, water precipitates from their alcoholic solution those substances (*e. g.* resin and oil) not soluble in water. By the mixture of alcohol and water heat is evolved, while air-bubbles are so copiously developed, that for a few moments the liquid appears turbid. When cold, the resulting compound is found to possess a greater density than the mean of its constituents; but as the condensation varies with the proportions of alcohol and water employed, the sp. gr. of the resulting compound can be ascertained by experiment only. The maximum condensation is obtained by mixing 54 vols. of alcohol with 49·77 vols. of water: the resulting compound measures 100 vols., so that the condensation is 3·77. If we regard this as a definite compound of alcohol and water, its composition may thus be stated:—

				Rudberg.	
	Eq.	*Eq. Wt.*	*Per Cent. Wt.*	*Vols.*	*Weight.*
Alcohol	1	23	46	54·00	42·91
Water	3	27	54	49·77	49·77
Terhydrate of Alcohol	1	50	100	100·00 [condensation 3·77]	92·68

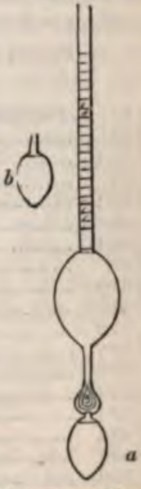
Alcohol combines with certain salts (as the chlorides and nitrates) to form definite compounds, which have been termed *alcohates*, in which the alcohol appears to act as a substitute for the water of crystallisation. Alcohol is a solvent of many organic substances, as volatile oil, fixed oil, resin, extractive, most varieties of sugar, many nitrogenous organic acids, the vegetable alkalies, urea, caseine, gliadine, leucine, and osmazome. It prevents the putrefaction of animal substances, and is, in consequence, extensively employed in the preservation of anatomical preparations. It acts, in part at least, by excluding air (oxygen) and water,—the two powerful promoters of putrefaction; for when animal substances are immersed in spirit, this fluid abstracts water from the tissue, which, in consequence, shrivels up, and prevents putrefaction by removing one of the conditions essential to the process, namely, the presence of water. Its attraction for water, and its power of coagulating albuminous substances, are properties which probably assist in rendering it an antiseptic. Alcohol and rectified spirit of wine give greater firmness to, and whiten, the animal tissues. The latter property is objectionable in the preservation of some morbid specimens, as gelatiniform cancer (*cancer gélatiniforme* or *aréolaire* of Cruveilhier,—the *matière colloïde* of Laennec). A mixture of one part rectified spirit and three water will, however, preserve specimens of the last-mentioned disease in a transparent condition.

CHARACTERISTICS.—Alcohol and ardent spirits are recognised by their inflammability, odour, taste, and miscibility with water. They dissolve camphor and resin. In order to detect alcohol in liquids supposed to contain it, let the suspected liquor be submitted to distillation with a gentle heat (as from a vapour or water-bath), and to the distilled liquid add dry carbonate of potash, to abstract the water. The alcohol, if in sufficient proportion, floats on the surface of the alkaline solution, and may be recognised by the characters above mentioned, (especially by its power of dissolving camphor). [Potassium does not take fire on alcohol unless much diluted with water. The presence of water in alcohol is indicated, not only by its sp. gr., but by adding to it white anhydrous sulphate of copper. The salt should not become blue.—ED.]

COMPOSITION.—The elementary constituents of alcohol are carbon, hydrogen, and oxygen; [and, according to the views of modern chemists, the formula for this compound is $C^4H^6O^2=46$, or $AeO+HO$; *i. e.* alcohol is regarded as a hydrated oxide of ethyle, a compound radical, which has been procured in a separate state by Dr. Frankland. The elementary composition of alcohol, $C^4H^6O^2$, represents 2e bicarburetted hydrogen, and 2e water ($2C^2H^2+2HO$). It has been long known as a source of bicarburetted hydrogen by the action of sulphuric acid at a high temperature. M. Berthelot has lately announced the synthesis of alcohol as a result of agitating bicarburetted hydrogen in a close vessel with sulphuric acid and a quantity of mercury.[1]—ED.]

ALCOHOLOMETRY.—The value of ardent spirit is, of course, proportionate to the quantity of alcohol contained therein; and, therefore, a ready mode of estimating this is most desirable. The alcoholometrical method usually adopted consists in determining the sp. gr. of the liquid by an instrument called the *hydrometer* (from *ὕδωρ, water,* and *μετρον, a measure*). That employed in this country, in the collection of the duties on spirits, is called *Sikes's hydrometer* (fig. 82). Spirit having the sp. gr. 0·920, at 60° F., is called *proof spirit;* that which is heavier is said to be *under proof,* while that which is lighter is called *over proof.* The origin of these terms is as follows:—Formerly a very rude mode of ascertain-

FIG. 82.



Hydrometer, with one of its ballast weights (a). b. Another weight.

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[1] *Journal de Chimie Médicale*, 1855, p. 175.

ing the strength of spirits was practised, called the *proof:* the spirit was poured upon gunpowder, in a dish, and inflamed. If at the end of the combustion the gunpowder took fire, the spirit was said to be *above* or *over proof;* but if the spirit contained much water, the powder was rendered so moist that it did not take fire: in this case the spirit was declared to be *below* or *under proof.* As spirit of different strengths will or will not inflame gunpowder, according to the quantity of spirit employed, it became necessary to fix the legal value of proof spirit. *Spiritus tenuior*, Ph. L. is defined, by act of parliament, to be such, that at the temperature of 5° F., thirteen volumes of it weigh exactly as much as twelve volumes of water. According to this definition the sp. gr. at 60° F. is 0·920, and spirit of this strength consists of—

	By Weight.	*Sp. Gr.*
Alcohol	49	0·791
Water	51	1·000
Proof spirit	100	0·920

Spirit which is of the strength of 43 *per cent. over proof* at the least, is recognised by the legislature[1] as *spirits of wine.* All spirit under this strength is known in trade as *plain spirit.* Distillers[1] are not permitted[2] to send out spirits at any other strengths than 25 or 11 *per cent.* above or 10 *per cent. below proof.* Raw corn-spirit, therefore, is sold at 25 or 11 per cent. above proof. *Compounded spirits* (as *Gin*) are not allowed[3] to be kept or sent out stronger than 17 *per cent. under proof;* but Gin, as sold by the rectifier, is usually 22 *per cent. under proof. Foreign or Colonial spirits* (not being compounded colonial spirits) must not be kept or sent out of less strength than 17 *per cent. under proof.*[4] Rum and Brandy, as commonly sold, are 10 *per cent. under proof.*

A series of carefully drawn-up tables, showing the relation which exists between the sp. gr. of spirit of different strengths, and the indications of Sikes's hydrometer, is a great desideratum. Mr. Gutteridge[5] has published some tables; but several of his statements do not coincide with experiments which I have made on the subject. The following are extracts from his work:—

	SIKES'S HYDROMETER.	*Sp. Gr. at* 60° F.
Over proof.	70 per centum	0·8095
	64	0·8221
	63·1	0·8238
	62	0·8259
	61·1	0·8277
	60	0·8298
	59·1	0·8315
	58	0·8336
	57·1	0·8354
	56	0·8376
	55·9	0·8379
	55·7	0·8383
	55·0	0·8396
	54·1	0·8413
	50·1	0·8482
	43·1	0·8597
	25	0·8869
	11·1	0·9060

	SIKES'S HYDROMETER.	*Sp. Gr. at* 60° F.
	Proof	0·9200
Under proof.	5 per centum	0·9259
	10	0·9318
	11	0·9329
	15·3	0·9376
	17·1	0·9396
	20	0·9426
	22·3	0·9448
	23·1	0·9456
	25·1	0·9476
	30·1	0·9522
	40·1	0·9603
	50·3	0·9673
	60·4	0·9734
	70·1	0·9790
	80·4	0·9854
	90·2	0·9922
	100 (water)	1·0000

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[1] 6 *Geo. IV.* cap. 80, Sects. 101 & 114.

[2] *Ibid.* Sect. 81.

[3] *Ibid.* Sect. 124.

[4] *Ibid.* Sect. 130.

[5] *The Ne Plus Ultra of Assaying, Weighing, Measuring, and Valuing of Spirituous Liquors*, vol. ii. By W. Gutteridge. London, 1828.

The sp. gr. of spirit may be readily ascertained by *Lovi's beads*, or by the *specific gravity bottle.*

Table of the Specific Gravities of Mixtures of Spirit (0·825 *at* 60° F.) *and Water at* 60° F.[1]

Temperature 60° F.	*Sp. Gr.*	*Temperature* 60° F.	*Sp. Gr.*
Spirit 100 + Water 0	0·82500	Water 100 + Spirit 95	0·93247
" 100 + " 5	0·83599	" 100 + " 90	0·93493
" 100 + " 10	0·84568	" 100 + " 85	0·93749
" 100 + " 15	0·85430	" 100 + " 80	0·94018
" 100 + " 20	0·86208	" 100 + " 75	0·94296
" 100 + " 25	0·86918	" 100 + " 70	0·94579
" 100 + " 30	0·87568	" 100 + " 65	0·94876
" 100 + " 35	0·88169	" 100 + " 60	0·95181
" 100 + " 40	0·88720	" 100 + " 55	0·95493
" 100 + " 45	0·89232	" 100 + " 50	0·95804
" 100 + " 50	0·89707	" 100 + " 45	0·06122
" 100 + " 55	0·90144	" 100 + " 40	0·96437
" 100 + " 60	0·90549	" 100 + " 35	0·96752
" 100 + " 65	0·90927	" 100 + " 30	0·97074
" 100 + " 70	0·91287	" 100 + " 25	0·97409
" 100 + " 75	0·91622	" 100 + " 20	0·97771
" 100 + " 80	0·91933	" 100 + " 15	0·98176
" 100 + " 85	0·82225	" 100 + " 10	0·98654
" 100 + " 90	0·92499	" 100 + " 5	0·99244
" 100 + " 95	0·92758	" 100 + " 0	1·00000
" 100 + " 100	0·93002		

Another mode of judging of the strength of spirits is the phial test, technically called the *bead;* the *preuve d'Hollande* of the French. It consists in shaking the spirit in a phial, and observing the size, number, and bursting of the bubbles (or beads as they are termed): the larger and more numerous the beads, as well as the more quickly they break, the stronger the spirit. Hitherto chemical analysis has been of little avail in determining the strength of spirit, at least for commercial purposes; for, on the one hand, we are yet in want of an accurate method of determining the relative quantities of alcohol and water in mixtures of these fluids; while, on the other, the combustion of spirit by the black oxide of copper, and the estimation of the quantity of alcohol by the carbonic acid produced, is impracticable for ordinary purposes.

[The strength of alcoholic liquids may be, in general, determined by the following process. Place four ounces of the liquid in a retort, and distil two ounces at a very low temperature. Make up the distilled liquid in the receiver to four ounces with distilled water, and agitate the mixture until the liquids are thoroughly incorporated. When the mixture is quite cold, its specific gravity may be taken by the bottle, and the temperature being noted, its strength may be read off by the aid of the above table.—ED.]

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—Alcohol acts on plants as a rapid and fatal poison. Its effects are analogous to those of hydrocyanic acid.

β. On Animals.—Leeches immersed in spirit die in two or three minutes. Their bodies are shrivelled or contracted, and before death they make but few movements; the head and tail of the animal are drawn together. Fontana[1] found, that when half the body of a leech was plunged in spirit, this part lost all motion, whilst the other half continued in action. The same experimentalist observed, that spirit killed frogs, when administered by the stomach (in doses of 40 drops), injected beneath the skin, or when applied to the brain or spinal marrow. Plunging the heart of this animal into spirit caused its motion to cease in twenty seconds. Applied to the right crural nerve of a frog, it destroyed the power of moving in the right foot, on the application of stimulus. Monro[2] observed that alcohol applied to the hind legs of a frog rendered the pulsations of the heart less frequent, and diminished sensibility and mobility. Fontana[3] states, that turtles were killed by spirit administered by the stomach or by the anus, or injected beneath the skin: before death, the animal became motionless: applied to the heart of these animals, it destroyed the contractility of this viscus. Some very interesting experiments were made with spirit on birds by Flourens.[4] This distinguished physiologist administered six drops of alcohol to a sparrow, whose skull he had laid bare. In a few minutes the animal began to be unsteady both in walking and flying. After some time a dark red spot appeared on the skull, in the region of the cerebellum, and became larger and deeper coloured in proportion as the alcohol more powerfully affected the animal. I have given alcohol to birds, but have hitherto been unable to discover the physical changes here stated. In some other experiments, Flourens observed that alcohol produced the same effects on the movements of birds as the removal of the cerebellum occasioned, but that when alcohol was administered, the animal lost the use of his senses and intellectual faculties; whereas, when the cerebellum was removed, no alcohol being given, he preserved them. From these and other observations, Flourens is of opinion that alcohol, in a certain dose, acts specifically on the cerebellum, and that in larger doses it affects other parts also. Furthermore, he thinks the physical action of alcohol on the cerebellum to be absolutely the same as a mechanical lesion.

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[1] Drawn up from Gilpin's Tables in the *Philosophical Transactions* for 1792.—The spirit, which Mr. Gilpin called alcohol, was composed of 89 alcohol (sp. gr. 0·796 at 60° F.) and 11 water.

The effect of alcohol on fishes is analogous to that on other animals. If a little spirit be added to water, in which are contained some minnows (*Cyprinus phoxinus*, Linn.), the little animals make a few (spasmodic?) leaps, and become incapable of retaining their proper position in the water, but float on their sides or back. If removed into pure water they soon recover.

The mammals, on which the effects of alcohol have been tried, are dogs, cats, horses, rabbits, and guinea-pigs. The principal experimentalists are, Courten,[5] Fontana,[6] Viborg,[7] Brodie,[8] and Orfila.[9] The results of their experiments may be thus briefly expressed:—Four drachms of alcohol, injected into the jugular vein of a dog, coagulated the blood, and caused instant death (Orfila). Introduced into the stomach of cats, dogs, or rabbits, it produces an apoplectic condition (Brodie and Orfila): this state is preceded, according to Orfila, by a strong excitement of the brain. The same experimentalist found that alcohol acts with less energy when injected into the cellular texture than when introduced into the stomach: from this he infers that its first effects are the result of the action which it exerts on the extremities of the nerves; though he admits that ultimately it becomes absorbed. On examining the bodies of animals killed by introducing alcohol into the stomach, this viscus has been found in a state of inflammation.

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[1] *Treatise on the Venom of the Viper*, translated by J. Skinner, vol. ii. p. 371, *et seq.*

[2] *Essays and Observ. Physic. and Literary*, vol. iii. p. 340.

[3] *Op. cit.* p. 365, *et seq.*

[4] *Recherches sur les fonctions et les propriétés du système nerveux dans les animaux vertébrés.* Paris, 1824.

[5] *Philosophical Transactions* for 1712.

[6] *Op. supra cit.*

[7] *Abhandl. für Thierärzte*, Theil II. quoted by Wibmer, *Die Wirkung*, &c.

[8] *Philosophical Transactions* for 1811.

[9] *Toxicologie Générale.*

γ. *On Man.*—The effects of alcoholic liquors on man vary with the strength of the liquid, the substances with which the alcohol is combined, the quantity taken, and the constitution of the patient.

αα. *The local effects of alcohol* or *rectified spirit* are those of a powerfully irritant and caustic poison. To whatever part of the body this agent is applied it causes contraction and condensation of the tissue, and gives rise to pain, heat, redness, and other symptoms of inflammation. These effects depend partially or wholly on the chemical influence of alcohol over the constituents of the tissues: for the affinity of this liquid for water causes it to abstract the latter from soft living parts with which alcohol is placed in contact; and when these are of an albuminous or fibrinous nature, it coagulates the liquid albumen or fibrin, and increases the density and firmness of the solid albumen or fibrin. The irritation and inflammation set up in parts to which alcohol is applied, depend (in part) on the resistance which the living tissue makes to the chemical influence of the poison: in other words, it is the reaction of the vital powers brought about by the chemical action of the alcohol. But, besides the local influence of this liquid, dependent on its affinity, we can hardly refuse to admit a dynamical action, in virtue of which it sets up local irritation and inflammation, independent of its chemical agency. The coagulation of the blood contained in the vessels of the part to which this liquid is applied (an effect which Orfila observed when he killed an animal by injecting alcohol into the cellular tissue of the thigh of a dog), depends on the chemical influence of the poison.

ββ. *The remote effects of ardent spirits* on man may be conveniently considered in the order of their intensity; and for this purpose we may divide them into three degrees or stages.[1]

1. FIRST OR MILDEST DEGREE. EXCITEMENT.—This is characterised by excitement of the vascular and nervous systems. The pulse is increased in frequency, the face flushed, the eyes animated and perhaps red, the intellectual functions are powerfully excited, the individual is more disposed to joy and pleasure; cares disappear; the

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[1] The newspaper reports of the proceedings at the Metropolitan Police Offices furnish examples of the employment, by the lower classes, of certain terms to designate the different degrees of the effects of fermented and spirituous liquors. When an individual is merely excited, he is described as *fresh*; but neither tipsy nor drunk. When the disordered intellect is just commencing, he is said to be *half seas over*. When he is beginning to be unsteady in his gait, he is described as being *tipsy*. When he reels, falls about, is incapable of standing, but is yet sensible, he is said to be *drunk*. And, lastly, when he is insensible or nearly so, he is described as *dead drunk*.—Sir Walter Scott (*Waverley*) distinguishes *fuddled* or *half seas over* (*ebriolus*) from *drunken* (*ebrius*).

ideas flow more easily, and are more brilliant. At this period the most violent protestations of love and friendship are frequently made; there is a strong disposition to talk, and various indiscretions are oftentimes committed (*In vino veritas*). This degree of effect I presume to be the condition to which all persons aspire in drinking: the unfortunate drinks to drown his cares; the coward to give him courage; the *bon-vivant* for the sake of enjoying the society of his friends; the drunkard from mere sensuality. None, perhaps, would wish to go beyond this, yet many, when they have got thus far, exceed their intended limit.

2. SECOND DEGREE. INTOXICATION OR DRUNKENNESS.—The essential character of this stage is a disordered condition of the intellectual functions and volition; manifested by delirium, varying in its characters in different individuals, and by an incapability of governing the action of the voluntary muscles. This state is accompanied with excitement of the vascular system, and frequently with nausea and vomiting: it is followed by an almost irresistible desire for sleep, which usually continues for several hours, and is attended with copious perspiration. When the patient awakes he complains of headache, loathing of food, great thirst, and lassitude: the tongue is furred, and the mouth clammy.

During a paroxysm of drunkenness, certain peculiarities are observed in the character of the delirium in different individuals. These appear to depend on what is commonly denominated temperament. Mr. Macnish[1] has offered a classification of drunkards, founded on these peculiarities. He describes the *sanguineous drunkard, the melancholy drunkard, the surly drunkard, the phlegmatic drunkard, the nervous drunkard,* and *the choleric drunkard.*

3. THIRD DEGREE. COMA OR TRUE APOPLEXY.—This condition is usually observed when excessive quantities of spirit have been swallowed in a short time. According to Dr. Ogston, the patient is sometimes capable of being roused; the pulse is generally slow, the pupils are usually contracted, but more commonly dilated, and the breathing is for the most part slow: but exceptions exist to all these statements. Convulsions are rare: when they occur the patients are usually young. In some cases actual apoplexy (with or without sanguineous extravasation) is brought on. The immediate cause of death appears to be either paralysis of the muscles of respiration, or closure of the glottis.

CONSEQUENCES OF HABITUAL DRUNKENNESS.—The continued use of spirituous liquors gives rise to various morbid conditions of system, a few only of the most remarkable of which can be here referred to. One of these is the disease known by the various names of *delirium tremens, d. potatorum, oinomania,* &c., and which is characterised by delirium, tremor of the extremities, watchfulness, and great frequency of pulse. The delirium is of a peculiar kind. It usually consists in the imagined presence of objects which the patient is anxious to seize or avoid. Its pathology is not understood. It is sometimes, but not constantly, connected with, or dependent on, an inflammatory condition of the brain or its membranes. Sometimes it is more allied to nervous fever. Opium has been found an important agent in relieving it.

Insanity is another disease produced by the immoderate and habitual use of spirituous liquors. In 110 cases of this disease, occurring in male patients admitted into the Hanwell Asylum in 1840, no fewer than 31 were ascribed to intemperance, while 34 were referred to combined causes, of which intemperance was stated to be one. It is remarkable, however, that of 70 female patients, admitted during the same year, only four cases were ascribed to intemperance.[2]

Disease of the liver is frequently met with in drunkards who use ardent spirits. It is generally of the kind termed, by Baillie, *common tubercle of the liver*; by Dr. Elliotson,[1] the *gin liver*; by others, *granulated, lobulated, mamellated,* or *scirrhous liver.* Laennec calls it *cirrhosis* (from κιῤῥὸς, *yellowish*), in reference to its usual tawny, yellow colour. A beautiful representation of it is given by Cruveilhier.[2] Dr. Carswell[3] has described it as consisting in atrophy of the lobular structure of the liver, produced by the presence of a contractile fibrous tissue. It is not, therefore, a disease depending on the formation of a new tissue. The ascites, which so frequently accompanies it, arises from the compression to which the portal vessels are subjected by the fibrous tissue; and the jaundice, another frequent effect of it, doubtless depends on compression of the gall ducts. Some excellent remarks on this disease have been made by the late Dr. Hope.[4]

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[1] *The Anatomy of Drunkenness*, 2d ed. p. 43, Glasgow, 1828.

[2] *Report of the Resident Physician* [Dr. Conolly] *of the Hanwell Lunatic Asylum, presented to the Court of Quarter-Sessions at the Middlesex Sessions*, 1840.

Stomach affections are common results of dram-drinking. Persons addicted to the use of ardent spirits suffer from loss of appetite, and are usually dyspeptic; and chronic inflammation of the stomach, or even a scirrhous state of the pylorus, has been said to be occasionally produced by hard drinking. Dram-drinkers are sometimes affected with *granular disease of the kidneys*, which is generally attended by albuminous urine. Dr. Hope regards this state as corresponding to the granular liver just described.[5]

PECULIARITIES OF INTOXICATION FROM SPIRIT.—Different kinds of ardent spirits present some peculiarities in their operation on the system, which will be noticed hereafter (see *Brandy, Rum, Gin, Whiskey,* and *Arrack*).

The effects of spirit agree, in a considerable number of circumstances, with those of wine, but present some peculiarities. Spirit more speedily induces excitement, which, however, is of shorter duration, being more rapidly followed by collapse, relaxation, or debility. Death is by no means an unfrequent consequence of deep intoxication from spirit. Dram-drinkers suffer usually from loss of appetite, especially in the morning, when they are troubled with vomiting: moreover, they are usually thin, wasted, and emaciated. Wine-bibbers, on the other hand, often enjoy an unimpaired appetite, and are frequently plump or corpulent, plethoric individuals. Liver disease, from intemperance, is said to be peculiar to those who take ardent spirits. Organic disease of the stomach is also a consequence of spirit-drinking. A somewhat similar distinction holds good between the effects of spirit and those of malt liquors. The latter possess nutritive properties in addition to narcotic powers: hence we frequently observe that the beer toper is a plethoric, corpulent individual.[6]

The effects of opium are readily distinguished from those of spirit when insensibility has not come on. The sleep which both these agents commonly induce is not usually preceded, in the case of opium, by delirium, thickness of voice, and peculiar difficulty of articulation. When delirium is produced by this drug (opium) it is rather of the ecstatic kind. "There is more poetry in its visions—more mental aggrandisement—more range of imagination."[1] But when insensibility is present, the diagnosis is not always easy. The odour of the breath is in these cases an important diagnostic. Moreover, the pupil is usually (though not invariably) dilated by spirit, whereas it is contracted by opium.

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[1] *London Medical Gazette*, vol. xii. p. 484.

[2] *Anatom. Patholog.* liv. 12, pl. 1.

[3] *Pathological Anatomy*, art. *Atrophy.*

[4] *Principles and Illustrations of Morbid Anatomy.* Lond. 1834.

[5] See also Dr. Christison, *On Granular Degeneration of the Kidneys*, p. 110. Edinb. 1839.

[6] Hogarth, in his *Beer Alley* and *Gin Lane*, has well represented the differences between drunkards devoted to malt liquors, and those given to the use of spirit. The first are plump, rubicund, and bloated; the latter are pale, tottering, emaciated, and miserable.

MODUS OPERANDI.—That alcohol becomes absorbed is proved by the fact that it has been found in the blood, in the urine, the breath, the bile, the fluid of the serous membranes, the brain and the liver. Tiedemann and Gmelin[2] recognised the odour of it in the blood of the splenic vein, though they were unable to detect it in the chyle. A similar observation is reported by Magendie.[3] Dr. Percy[4] also found it in the blood of animals to which he administered it. He likewise detected it in the urine and the bile. Moreover, the recognition of the odour of alcoholic liquors in the breath of individuals who have swallowed them, as well as their detection by the smell in the fluid contained in the ventricles of the brain and in the pericardium, prove indisputably that alcohol is absorbed. Dr. Cooke[5] states, on the authority of Sir A. Carlisle, that in one case the fluid of the ventricles of the brain had the smell, taste, and *inflammability* of gin. Dr. Christison[6] has questioned the correctness of this observation, on the ground that gin of sufficient strength to take fire could not enter the blood-vessels without coagulating the blood. But the objection appears to me to be groundless; for I find that a small quantity of undiluted commercial gin may be added to white of egg without causing either coagulation or the slightest opacity. Dr. Ogston[7] has confirmed the testimony of Carlisle, and states that in one case he found about four ounces of fluid in the ventricles, having all the physical qualities of alcohol. Dr. Percy[8] has recently set the question at rest, and satisfactorily proved the accuracy of the above statements, by his experiments on animals. He appears to think that some peculiar affinity exists between the substance of the brain and the spirit; more especially as, after analysing a much larger quantity of blood than can possibly exist in the cranium, he could generally obtain much more alcohol from the brain than from this quantity of blood. He was unable to determine whether or not the fluid of the ventricles contained any alcohol. Dr. Percy also detected alcohol in the liver, and has endeavoured to connect this fact with the frequent occurrence of hepatic disease in drunkards.

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[1] *The Anatomy of Drunkenness*, by Robert Macnish; p. 63, 2d ed. Glasgow, 1828.

[2] *Uber die Wege auf welchen Substanzen aus dem Magen ins Blut gelangen*, Heidelberg, 1820.

[3] *Element. Compend. of Physiology*, by Dr. Milligan, p. 248, 1823.

[4] *An Experimental Inquiry concerning the presence of Alcohol in the Ventricles of the Brain, after Poisoning with that liquid, together with Experiments illustrative of the Physiological Action of Alcohol*, Lond. 1839.

[5] *Treatise on Nervous Diseases*, i. 222, Lond. 1820.

[6] *Treatise on Poisons*, 3d ed. p. 853.

[7] *Edinburgh Medical and Surgical Journal*, vol. xl.

[8] *Op. supra cit.*

[Dr. Böcker's experiments on himself are of some interest in reference to the *modus operandi* of alcohol. This gentleman took seven or eight times daily a teaspoonful of spirits of wine, while he continued to live as usual. The effects which he observed were:—1. Alcohol thus taken in divided doses diminishes the excretion of the solid and fluid constituents of the urine. 2. It does not increase the cutaneous exhalation. 3. It does not augment the fæcal excretions. 4. It diminishes not only the absolute quantity, but the relative proportion, of carbonic acid exhaled by the lungs. 5. The amount of water excreted by the lungs is not perceptibly altered. The general conclusion from these experiments is, that alcohol has a tendency to arrest the metamorphosis of the tissues.[1] Long previously to Dr. Böcker's experiments, Dr. Prout had arrived at substantially the same conclusions respecting the operation of alcohol on the body. When in the blood it does not serve as fuel for the oxygen, but, as he observes, "Alcohol, in every state and in every quantity, uniformly lessens in a greater or less degree the quantity of carbonic acid gas elicited, according to the quantity and circumstances under which it is taken. Dr. Snow, from his researches, has also arrived at the conclusion, that alcohol, like chloroform and ether, diminishes the processes of oxidation in the body; hence the lowering of the temperature and the alteration in the colour of the blood."[2] Böcker's results, therefore, afford only further confirmation to the views already promulgated by Drs. Prout and Snow. The diminution in the constituents of the urine is a further proof of the diminished oxidation caused by the presence of alcohol in the blood.—ED.]

MORBID APPEARANCES.—On examining the bodies of individuals who have been poisoned by ardent spirits, redness and inflammation of the stomach are sometimes, but not invariably, found. In confirmed drunkards the mucous membrane of the stomach is often injected and thickened. Congestion of the cerebral vessels, with or without extravasation of blood or effusion of serum, is not unfrequently observed. Traces of spirit may or may not be found in the stomach, according to the rapidity with which death has been produced. The odour of spirit may perhaps be recognised in various parts of the body, especially in the brain and the serous cavities.

USES.—Spirit of wine is employed both for medicinal and pharmaceutical purposes.

1. *MEDICINAL USES.*—Spirit is used both internally and externally:—

a. **Internally.**—Spirit of wine is rarely administered internally; for when ardent spirit is indicated, Brandy, Gin, or Whiskey, is generally employed. The separate uses of each of these will be noticed presently: at present, therefore, I shall confine myself to some general remarks on the internal employment of spirit. I may observe, however, that Brandy is the ardent spirit usually administered for medicinal purposes; and, unless otherwise stated, is the spirit referred to in the following observations.

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[1] [The reader will find these views fully expounded in Dr. T. K. Chambers's work on *Digestion and its Derangements*, 1856.—ED.]

[2] [See *Medical Gazette*, vol. xxxix. (1847), p. 383; also vol. xlvii. (1851), p. 626.—ED.]

As a *stomachic stimulant,* spirit is employed to relieve spasmodic pains and flatulency, to check vomiting (especially sea-sickness), and to give temporary relief in some cases of indigestion, attended with pain after taking food. As a *stimulant and restorative,* it is given with considerable advantage in the latter stages of fever. As a *powerful excitant,* it is used to support the vital powers, to prevent fainting during a tedious operation, to relieve syncope and languor, and to assist the restoration of patients from a state of suspended animation. In *delirium tremens* it is not always advisable to leave off the employment of spirituous liquors at once, since the sudden withdrawal of the long-accustomed stimulus may be attended with fatal consequences. In such cases it is advisable to allow, temporarily, to the patient the moderate use of the particular kind of spirit which he has been in the habit of employing. In *poisoning by foxglove and tobacco,* spirit and ammonia are used to rouse the action of the heart. In *mild cases of diarrhœa,* attended with griping pain, but unaccompanied by any inflammatory symptoms, a small quantity of spirit and water, taken warm, with nutmeg, is often a most efficacious remedy.

β. **Externally.**—Spirit of wine is used externally for several purposes, of which the following are the principal:—*As a styptic,* to restrain hemorrhage from weak and relaxed parts. It proves efficacious in two ways: it coagulates the blood by its chemical influence on the liquid, albumen, and fibrin, and it causes the contraction of the mouths of the bleeding vessels by its stimulant and astringent qualities. Sponge or soft linen, soaked in spirit and water, has been applied to the mouth of the uterus in uterine hemorrhage.[1] *Spirit is employed to harden the cuticle over tender and delicate parts.* Thus, brandy is sometimes applied to the nipples, several weeks before delivery, in order to prevent the production of sore nipple from suckling in individuals predisposed to it. Spirit is also applied to the feet, when the skin is readily blistered by walking. The efficacy of spirit, in hardening the cuticle, depends, in part, on its chemical influence. Spirit gargles have been found serviceable in checking the tendency to inflammation and swelling of the tonsils. *As a stimulant application,* warm rectified spirit has been applied to burned or scalded parts, on the principles laid down for the treatment of these cases by Dr. Kentish.[2] Properly diluted, spirit has been employed as a wash *in various skin diseases,* and *in ulcers of bed-ridden persons,* and as a *collyrium* in chronic ophthalmia. *Frictions with rectified spirits* have been used in the abdominal region, to promote labour pains; on the chest, to excite the action of the heart, in fainting or suspended animation; on the hypogastric region, to stimulate the bladder, when retention of urine depends on inertia, or a paralytic condition of this viscus; on various parts of the body, to relieve the pain arising from bruises, or to stimulate paralysed parts.

The inhalation of the vapour of rectified spirit has been recommended to relieve the irritation produced by the inspiration of chlorine; but I have tried the practice on myself without benefit. The readiest mode of

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Richter, *Ausführliche Arzneimittellehre,* 3 Bd. S. 256, Berlin, 1828.

An Essay on Burns, Lond. 1798; *A Second Essay on Burns,* Newcastle, 1800.

effecting it is to drop some spirit on a lump of sugar, and hold this in the mouth during inspiration.

Diluted spirit has been used *as an injection for the radical cure of hydrocele.* A mixture of wine and water, however, is commonly employed in this country.

Spirit has been used to form cold lotions. As the efficacy of it depends on its evaporation, it should be applied by means of a single layer of linen, and not by a compress. Evaporating lotions are applied,—to the head in cephalalgia, in phrenitis, in fever, and in poisoning by opium; to fractures of the extremities; also to parts affected with erysipelatous inflammation.

ANTIDOTES. — The first object in the treatment of poisoning by spirituous liquors is to evacuate the contents of the stomach. This is best effected by the stomach-pump; emetics being frequently unsuccessful. Stimulants are then to be employed: the most effectual are the injection of cold water into the ears, cold affusion to the head and neck, warmth to the extremities when these are cold, and the internal use either of ammonia, or of the solution of the acetate of ammonia, both of which agents have been found useful in relieving stupor. The cerebral congestion often requires the cautious employment of local blood-letting, and the application of cold to the head. If the patient appear to be dying from paralysis of the respiratory muscles, artificial respiration should be effected: if from closure of the larynx, tracheotomy may be performed.

1. SPIRITUS VINI GALLICI; *Brandy;*[1] *Eau-de-vie.*—This is an ardent spirit obtained by the distillation of wine. Its properties are subject to some variation, arising from different growths of the wine: "the brandies of Languedoc, Bordeaux, Armagnac, Cognac, Aunis, Saintonge, Rochelle, Orleans, Barcelona, and Naples, being each recognisable by an experienced dealer."[2] The most celebrated of the French brandies are those of Cognac and Armagnac. Genuine brandy has an agreeable, vinous, aromatic odour. Both its flavour and odour, however, are peculiar. *Pale brandy* has a very slight brownish yellow tint, derived from the cask in which it has been kept. The *high coloured brandy*, usually found in the shops of this country, is artificially coloured (before its arrival in this country) by burnt sugar (caramel); which is said to render the spirit mellow and more palatable.[3] Saunders wood is also stated, by the same authority, to be frequently used as a colouring ingredient. The constituents of brandy are *alcohol, water, volatile oil,* a minute portion of *acetic acid,* a little *acetic ether, œnanthic ether, colouring matter,* and *tannin.* The latter is said to be derived from the cask in which the spirit has been preserved; but I find that the high coloured brandies react more powerfully on the salts of iron than pale brandy: whence I conclude that some astringent matter has been added to them.

Brandy when just imported is usually above proof. I found a sample of pale brandy, in bond, supplied to me by my friend, Mr. Gassiot, to be 1·5 *over proof;* and a coloured brandy 2·2 *over proof*, as indicated by Sikes's hydrometer. By keeping in the cask its alcoholic strength is diminished. I am informed that brandy, as usually sold, is 10 *per cent. under proof.* This would give, according to Gutteridge's table, a sp. gr. of 0·9318. But Soubeiran[1] states, that the sp. gr. of eau-de-vie varies from about 0·902 to 0·941. Now according to Gilpin's tables a spirit having the sp. gr. of 0·93002 is composed of equal parts of alcohol (sp. gr. 0·825) and water. But Mr. Brande states that 100 parts by measure of brandy contain 53·39 parts of alcohol, sp. gr. 0·825. The relative quantities of spirit contained in this and other ardent spirits, in wine, and in beer, have been already mentioned.

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[1] *Brandy* is a contraction for *Brandy-wine* (*Branntwein*, Ger.), which literally signifies *Burnt-wine* (*Vinum adustum*).

[2] Ure's *Dictionary of Arts and Manufactures*, p. 164, Lond. 1839.

[3] M'Culloch's *Dictionary of Commerce.*

British Brandy is extensively manufactured, and sold as foreign brandy. Dr. Ure[2] gives the following formula for it:—"Dilute the pure alcohol to the proof pitch; add to every hundred pounds weight of it from half a pound to a pound of argol (crude winestone) dissolved in water, a little acetic ether, and French-wine vinegar, some bruised French plums, and flavour-stuff from Cognac; then distil the mixture, with a gentle fire, in an alembic furnished with an agitator. The spirit which comes over may be coloured with nicely burned sugar (caramel) to the desired tint, and roughened in taste with a few drops of tincture of catechu or oak-bark."

Acrid matters (as Grains of Paradise) are sometimes added to brandy to give it an artificial strength: they may be readily detected by evaporation. Sugar, also, may be discovered in the same way. The residue of the evaporation of genuine brandy yields a green colour with the salts of iron, indicating the presence of tannin; and imitation brandy may be readily made to produce the same effect, by the addition of catechu, or some other astringent.

The general effects and uses of brandy are those of alcohol already described. From the ardent spirits in ordinary use it is distinguished by its cordial and stomachic properties; and it is, in consequence, the stimulant usually preferred for medicinal purposes.

Burnt Brandy is a popular remedy for diarrhœa.

2. **MISTURA SPIRITUS VINI GALLICI**, L.; (Brandy, Cinnamon Water, of each, f℥iv.; the yolks of two Eggs; Purified Sugar, ℥ss.; Oil of Cinnamon, ♏ij. Mix.)—This mixture is an imitation of a well-known compound, termed *Egg-flip.*[3] It is an exceedingly valuable stimulant and restorative; and is employed in the latter stages of low fever, and in extreme exhaustion from uterine and other hemorrhages. The dose of it is from f℥ss. to f℥iss.

3. **SPIRITUS SACCHARI**; *Rum.*—This is an ardent spirit obtained both in the West and East Indies, by distillation from the fermented skimmings of the sugar boilers, the drainings (called *molasses*) of the pots and

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[1] *Nouveau Traité de Pharmacie*, t. i. p. 142, 2nde éd.

[2] *Dictionary of Arts and Manufactures*, p. 165.

[3] The terms *Egg-flip*, *Egg-hot*, or simply *Flip*, are applied to a preparation of ale with egg and ardent spirit (see Dr. Kitchener's *Cook's Oracle*).

hogsheads of sugar, the washings of the boilers,[1] and the lees or spent wash of former distillations, called *dunder*.[2] It is imported into this country in puncheons. In some parts of the West India islands it is customary to put slices of pine-apples in the puncheons of rum: hence the designation *pine-apple rum*.

The term *Tafia*, or *Taffia*, is applied to a spirit obtained, by distillation, from the fermented juice of the sugar-cane.[3] It is, therefore, *Cane Spirit* (*Spiritus Succi Sacchari*).

Good rum is transparent and of a brownish tint. Its depth of colour, however, varies considerably. The peculiar flavour of rum depends on *volatile oil*. The quantity of *alcohol* (sp. gr. 0·825) in 100 vols. of rum is, according to Mr. Brande, about 53·68 vols. As sent out, its strength is 10 *per cent. under proof*, in the language of Sikes's hydrometer. *Jamaica rum* is more highly esteemed than the *Leeward Islands rum*.

The general effects and uses of rum are similar to those of alcohol already described.[4] It is considered more heating and sudorific than the other kinds of ardent spirit, to which it has been popularly thought preferable in coughs, catarrhs, and rheumatism.

4. SPIRITUS FRUMENTI COMPOSITUS; *Compound Corn Spirit.* — The spirit manufactured in the British Islands is usually obtained by distillation from fermented infusions of corn. The ardent spirits known as *Gin*, *Whiskey*, and the various *Compounds*,[5] are corn spirit differently flavoured.

Gin owes its peculiar flavour to the Juniper, whence it is frequently denominated *Spiritus Juniperi*. It is not allowed to be sent out stronger than 17 *per cent. under proof*; but it is usually sold to the trade at 22 *per cent. under proof*. The retail dealer always reduces its strength, and flavours it with sugar. Frequently also other additions are made to it. Gin possesses the general properties of alcohol. On account of the oil of juniper which it holds in solution, it is more powerfully diuretic

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[1] *The Civil and Natural History of Jamaica*, by P. Browne, M.D., p. 132, Lond. 1789.

[2] Dunder, from the Spanish *redundar*, to overflow.

[3] Mérat and De Lens, *Dict. de Mat. Méd.* t. vi. p. 150.

[4] "They talk of a common experiment here [Jamaica], that any animal's liver put into rum grows soft, and not so in brandy, whence they argue this last less wholesome than that: but their experiment, if true, proves no such thing. I think it may be said to have all the good and bad qualities of brandy, or any fermented or vinous spirit." — (Sloane's *Jamaica*, vol. i. p. xxx. Lond. 1707.)

[5] By spirit dealers, British compounded spirits are denominated *Compounds*, while foreign compounded spirits are called *Liqueurs*. Both classes of liquors are sweetened spirits.

The following list of Compounds, usually kept at the gin-shops of this metropolis, has been supplied to me by the proprietor of one of these establishments: —

Compounds.	*Under Proof.*	*Compounds.*	*Under Proof.*
Gin	17	Tent	64
Gin	22	Aniseed	"
Mint (*Peppermint*)	64	Caraway	"
Cloves	"	Lovage	"
Bitters	"	Usquebaugh (X)	"
Raspberry	"	Rum Shrub	"
Noyeau	"	Orange Cordial (X)	"
Cinnamon	"	Citron ditto (X)	"

"The above are permitted to us at the strengths named; but, in point of fact, are much nearer approaching 80 U. P. — Those marked thus (X) are seldom asked for."

than brandy and rum; and hence it is a popular remedy in dropsical and other affections, in which an augmentation of the renal secretion is considered desirable. Moreover, it is frequently used to promote menstruation. It is the ordinary intoxicating spirit of the lower classes in this metropolis. At the London Hospital, gin is frequently administered medicinally, as a substitute for brandy, to patients who have been accustomed to its use.

Whiskey agrees in most of its properties with gin, from which it differs in its peculiar smoky flavour and odour: these it acquires from the malt, which is dried by turf fires. It is the national spirit of Ireland and Scotland.

5. **ARRACK**, or **RACK**.—This is a spirit obtained in various parts of the East. In Batavia it is procured by distillation from fermented infusions of rice, whence it has been termed *Rice Spirit* (*Spiritus Oryzæ*). In Ceylon,[1] it is obtained by distillation from fermented cocoa-nut toddy (by some called *Palm Wine*).

"Pine apples, steeped in it, impart a most exquisite flavour to the spirit; and, by age, it becomes a delicious liqueur, which is unrivalled in the world for making nectarial punch." In England, arrack is never employed for medicinal purposes. In its general properties it agrees with the other ardent spirits; but is said to be distinguished by its stimulating and narcotic properties. It is sometimes used in this country to impart an agreeable flavour to *punch*. A mock arrack is made by dissolving twenty grains of benzoic acid in two pounds of rum.

2. *PHARMACEUTICAL USES OF ALCOHOL.*—Alcohol is not employed in the preparation of any officinal substances, but it is a valuable agent in chemical analysis, and is used in determining the purity of certain medicinal substances; as iodine, iodide of potassium, the vegetable alkalies, and castor oil. Rectified and proof spirits are most extensively employed in officinal pharmacy: as in the formation of *Tinctures*, *Spirits*, *Ethers*, *Ethereal Oil*, and *Resinous Extracts*, and in the manufacture of the *Vegetable Alkalies*. Lastly, spirit is added to various preparations to assist in preserving them.

1. **TINCTURÆ**, L. D.; *Tinctures*, E.; *Alcoolés.*—These are solutions of vegetable, animal, or mineral substances, in proof or rectified spirit. They are preparations of substances whose active principles are imperfectly or not at all soluble in water, or whose aqueous solutions readily undergo decomposition. Some are prepared by *solution* merely; as the *Tinctura Iodinii composita*, Ph. L.; *Tinctura Camphoræ*, Ph. Ed.; and *Tinctura Ferri Sesquichloridi*.

Some of the vegetable tinctures are prepared by adding rectified spirit to the expressed juices of plants. These preparations are frequently denominated *preserved vegetable juices*. They have been long in use on the continent. In 1835, Mr. Squire[2] commenced their manufacture. More recently, Mr. Bentley[3] has directed the attention of the profession to them.

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[1] *The Cocoa-Nut Palm, its Uses and Cultivation*, by J. W. Bennett, Esq., Lond. 1836.

[2] *Pharmaceutical Transactions*, No. iii. p. 94, Sept. 1841.

[3] *On the Best Method of obtaining the more powerful Vegetable Preparations for Medicinal Use.*

Mr. Squire states that, on an average, the juice of the young plant just coming into flower will yield only two-thirds of the amount of extract which is obtained from the same quantity of juice from the matured plant ("when more than half the flowers are fully blown"), and the strength of the product is also inferior. He also asserts[1] that the leaves only should be used; and in the case of biennial plants, those of the second year's growth should exclusively be employed.[2] The mode of obtaining these preparations is as follows:—The leaves being bruised in a marble mortar are placed in a powerful press. The expressed juice is allowed to stand for twenty-four hours, by which a considerable quantity of feculent matter is deposited. Rectified spirit [56 over proof] is then added, in the proportion of four fluidounces to every sixteen fluidounces of the juice, which is quite sufficient to render the preservation complete, and throw down any mucilage which may be mechanically suspended. After standing twenty-four hours the liquor is to be filtered.[3]

Mr. Squire employs one measure of spirit to two measures of juice.

These preserved expressed juices are superior preparations to the tinctures prepared by digestion from the same parts of either fresh or dried plants. In some cases (*e. g.* Aconite), tinctures prepared with rectified spirit from the dried roots, by digestion, are greatly superior in activity to the preserved juices of the leaves.

The ordinary method of preparing tinctures is by *maceration* or *digestion.*

"Tinctures are usually made by reducing the solid ingredients to small fragments, coarse powder, or fine powder, macerating them for seven days or upwards, in proof spirit or rectified spirit, straining the solution through linen or calico, and finally expressing the residuum strongly to obtain what fluid is still retained in the mass."—*Ph. E.*

"All Tinctures should be prepared in stoppered glass vessels, and frequently shaken during maceration."—*Ph. Lond.*

The tinctures which are made with resinous substances cannot in general be well prepared in any other way than by digestion. This remark applies to *Tinctura Aloes*, *Tinctura Assafœtidæ*, *Tinctura Benzoini composita*, *Tinctura Guaiaci*, and *Tinctura Balsami Tolutani.* Another and more expeditious method of preparing tinctures is by *percolation* or *lixiviation* (*procédé* ou *méthodé de déplacement*); and which is also applicable to the preparation of ethereal, as well as alcoholic, tinctures, and of infusions. The principle of this method has been adopted by the Scotch brewers; the process being called by them *sparging.* It has also been used in the preparation of coffee. It was first employed for pharmaceutical purposes by Boullay.[4] In the preparation of tinctures its professed advantages are expedition, economy, and uniformity of strength. But it is more troublesome, requires more skill and attention, and is not equally applicable to all substances. It answers best for those tinctures made with woody and fibrous parts, as roots, barks, woods, leaves, fruits, seeds, and insects. The Tinctures of Catechu and Myrrh may also be prepared in this way. The *Edinburgh College* offers the following remarks on this mode of preparation:—

"A much superior method, however, has been lately introduced, which answers well for most tinctures; namely, the method of displacement by percolation. According to

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[1] *Op. supra cit.*

[2] See the article *Hyoscyamus* for an account of the relative quantities of juice and extract yielded by the leaves and stalks.

[3] Bentley, *op. supra cit.*

[4] *Journal de Pharmacie*, t. xix. p. 393.

> this process, the solid materials, usually in coarse or moderately fine powder, are moistened with a sufficiency of the solvent to form a thick pulp. In twelve hours, or frequently without any delay, the mass is put into a cylinder of glass, porcelain, or tinned iron, open at both ends, but obstructed at the lower end by a piece of calico or linen, tied tightly over it as a filter; and the pulp being packed by pressure, varying as to degree with various articles, the remainder of the solvent is poured into the upper part of the cylinder, and allowed gradually to percolate. In order to obtain the portion of the fluid which is kept in the residuum, an additional quantity of the solvent is poured into the cylinder, until the tincture, which has passed through, equals in amount the spirit originally prescribed: and the spirit employed for this purpose is then recovered for the most part by pouring over the residuum as much water as there is of spirit retained in it, which may be easily known by an obvious calculation in each case. The method by percolation, where applicable, will be found much more convenient and expeditious than the mode hitherto commonly followed, and it exhausts the solid materials in general much more completely. As considerable practice, however, is required for managing the details in different cases, more especially in regard to the degree of firmness with which they are to be packed in the cylinder, we have thought it right to direct that the method of maceration may be followed as an alternative. But the method of percolation is now preferred by all who have made sufficient trial of it to apply it correctly."

The percolator is best made of tin plate or zinc. A simple tube (of glass, porcelain, or tinned iron), as stated by the Edinburgh College, answers for an extemporaneous percolator. It is fitted into the mouth of a wide-mouthed bottle by means of a cork (fig. 83), in which is a small aperture to allow of the escape of air. One of the most convenient percolators is that proposed by Boullay. It is a simple cylinder of equal diameter, and terminating inferiorly in a cone or funnel. Mr. Deane's percolator[1] (fig. 84) is a modification of this: its lower end, C D, has a smaller circumference than its upper one, A B; is flat, and communicates with a tube, to which a stop-cock is fitted. Soubeiran[2] has adapted to Boullay's percolator a tin receiver, to which is fitted, at the most depending part, a stop-cock, by which the tincture may be drawn off (fig. 85).

The size of the percolator must, of course, vary according to circum-

FIG. 83.

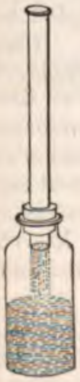


FIG. 84.

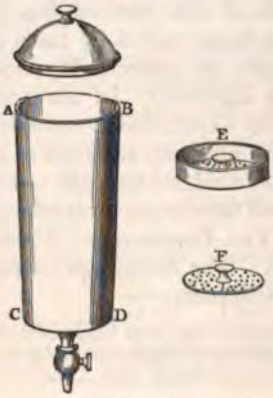
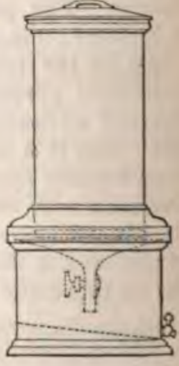


FIG. 85.



Tincture Percolators.

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[1] *Pharmaceutical Transactions*, part ii.

[2] *Nouveau Traité de Pharmacie*, t. i. p. iii. 2nde éd.

stances. The smallest may be half an inch in diameter and four inches long. Large ones are six inches in diameter and eighteen inches long. They should be furnished with two diaphragms (perforated metallic disks, fig. 84, E, F), between which the ingredients are placed. When small percolators are used, a little cotton-wool, or even tow, may be substituted for the lower diaphragm,—or a piece of calico or linen may be tied over the end of the tube, as directed by the Edinburgh College. The lower extremity of the percolator should be furnished with a stop-cock (see figs. 84 and 85) for regulating the discharge of the fluid.

Considerable skill and experience are required in packing the ingredients. Indeed the principal art of percolating has reference to this part of the process. Substances, as Rhubarb and Gentian, which yield a large quantity of mucilage, and are to be acted on by water, must be employed in the form of a very coarse powder, and should be placed loosely in the percolator, in order to allow them to swell. With alcohol or ether, however, the tissues swell less, the mucilaginous matter is not dissolved, and the percolation is readily effected even with a finer powder and closer packing.

Boullay imagined that one liquid may be employed to displace another liquid, without the two liquids becoming mixed: hence he called the process the *displacement method.* The Edinburgh College, I presume, has adopted his opinion, since it directs the tincture to be displaced by spirit, and the spirit by water. But Guilliermond[1] has shown that this displacement cannot be effected without a certain degree of mixture.[2]

2. **SPIRITUS**, L.; *Spirits*, E.; *Essentia*, D.—These are alcoholic solutions of volatile substances (usually of a vegetable nature) sometimes obtained by distillation. Some of them are prepared with rectified spirit (e. g. *Spiritus Rosmarini*), some with alcohol, as *Essentia Fœniculi*, D. The spirits which owe their peculiar flavour and odour to volatile oil are now prepared according to the directions of the *London College*, by dissolving the oil in spirit, without the aid of distillation; and, for all therapeutical purposes, they are equally effective.

313. ALCOHOL AMYLICUM.—AMYLIC ALCOHOL, OR FUSEL OIL.

[This compound, which is known under the names of *Oil of Grain, Potato Spirit Oil, Hydrate of Amyle*, and *Bihydrate of Amylene*, has been introduced into the Dublin Pharmacopœia under the above designation. The following process is recommended for procuring it. Take of the light liquid, which may be obtained at any large distillery by continuing the distillation for some time after the pure spirit has been all drawn off, any convenient quantity. Introduce it into a small still or retort connected with a condenser, and apply heat so as to cause distillation. As soon as the oil begins to come over unmixed with water, the receiver should be changed, and the distillation being resumed, and carried nearly to dryness, the desired product will be obtained. The liquid drawn over during the first part of the distillation will consist of an aqueous fluid, surmounted by a stratum of the fusel oil. This latter, though impregnated with a minute quantity of water, should be separated and preserved as being sufficiently pure for use.—ED.]

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[1] *Journal de Pharmacie*, t. xxi. p. 349.

[2] For further details respecting percolation, consult, besides the memoirs already quoted, Dansse, *Mémoire sur la préparation de tous les extraits pharmaceutiques par le méthode de déplacement*, Paris, 1836.

All ardent spirits contain a volatile oil which the Germans[1] call *Fuselöl*. In 1825, Pelletan[2] described the oil obtained from Potato Spirit, which was subsequently examined in 1838 by Dumas,[3] and in 1839 by Cahours.[4] The oil from corn spirit was described several years ago, by Buchner.[5] It has been long known to Messrs. Bowerbank, rectifiers, of London, who obtained it in the rectification of corn spirit. From them I procured it several years ago, under the name of *Oil of grain;* and, in 1836, noticed it in my lectures.[6] I am informed by them that they obtain from 500 gallons of corn spirit about one gallon of oil, which they employ as a substitute for lamp oil. In 1839, I gave a short description of its properties in the first edition of this work. It has since been more completely examined by Dr. Apjohn.[7] Under the name of *Oleum siticum,* Mulder[8] has described a peculiar oil, which he obtained from corn spirit.

PROPERTIES.—Oil of grain, as I received it from Messrs. Bowerbank, is a limpid, transparent liquid, of a pale yellow colour, nearly colourless, and having a very nauseous persistent odour, and a hot, acrid, nauseous taste. The inhalation of its vapour produces an unpleasant and persistent sensation in the throat, causing constriction of the chest and cough. When washed with water (to remove the alcohol), and subsequently distilled from chloride of calcium (to deprive it of water), it is quite colourless, and had, according to my experiments, a sp. gr. of 0·833 at 56° F. [0·813 at 60°, *Apjohn*]. It boils at about 268° F. Dr. Apjohn failed to congeal it at −6° F.; but Cahours congealed the oil from potato spirit at −4° F. It burns in the atmosphere, only when heated, with a flame like that of light carburetted hydrogen gas [with a bluish white flame, *Cahours*]. It dissolves iodine; and, according to Dr. Apjohn, is a good solvent for fats, resins, and camphor. It is not miscible with water, which, however, sparingly dissolves it. Neither is it miscible with liquor ammoniæ, nor with liquor potassæ. It dissolves in nitric acid, but acquires a slightly yellowish red tinge; and, when the mixture is heated, violent reaction takes place: nitrous fumes mixed with nitric ether are so rapidly evolved, that, if the experiment be performed in a tubulated retort, the stopper is sometimes driven out with considerable violence. When mixed with oil of vitriol, a violet- or blood-red coloured liquid, with the evolution of a mint-like odour, is produced, and, according to Cahours, *sulphoamylic acid* (bisulphate of oxide of amyle ($C^{10}H^{11}+O+2SO^3+Aq.$ is formed. When distilled with dry phosphoric acid it yields, according to the same authority, a carbo-hydrogen called *amylene* ($C^{10}H^{10}$). Potassium readily decomposes it with the evolution of hydrogen. If it be heated with fused potash, hydrogen is disengaged, and a compound of potash and *valerianic acid* ($C^{10}H^9O^3+Aq.$) is formed. [It becomes acid by keeping in contact with air, and valerianic acid appears as a product.—ED.]

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[1] L. Gmelin, *Handb. d. Chemie*, Bd. ii. S. 367.

[2] *Ann. de Chim. et de Physiq.* t. xxx. p. 221; and *Journ. de Chim. Méd.* t. i. p. 76.

[3] *Ann. de Chim. et de Physiq.* t. lvi. p. 314.

[4] Ibid. t. lxx. 81.

[5] *Repertorium*, xxiv. 270.

[6] *London Medical Gazette*, vol. xviii. p. 963.

[7] *Lond. Edin. and Dubl. Phil. Mag.* vol. xvii. p. 86. 1840.

[8] *Pharmaceutisches Central-Blätt* für 1837, S. 807.—*Siticus*, from σιτικὸς, of or pertaining to corn.

This oil is composed of carbon, hydrogen, and oxygen. Cahours regards it as the hydrated oxide of a hypothetical base, called *amule* or *amyle* ($C^{10}H^{11}$), and Liebig has adopted his views.

	Atoms.	*Eq. Wt.*	*Per Ct.*	*Apjohn.*	*Dumas.*	*Cahours.*
Carbon.....	10	60	68·18	68·13	68·6	68·90
Hydrogen..	12	12	13·64	13·33	13·6	13·58
Oxygen ...	2	16	18·18	18·54	17·8	17·52
Corn Spirit Oil......	1	88	100·00	100·00	100·0	100·00

Or,	*Atom.*	*Eq. Wt.*
Amule	1	71
Oxygen	1	8
Water	1	9
Hydrat. of Oxide of Amule ...	1	88

[Considering this compound as hydrated oxide of the compound radical amyle, its formula would be $C_{10}H_{11}O, HO = C_{10}H_{12}O_2$:—or Ayl. $(C_{10}H_{11})\,O, HO$. Its production in fermented liquids probably depends on a peculiar conversion of sugar. Thus, as Gregory has suggested, 5 equivalents of sugar will yield 4 eq. of amylic alcohol, 12 eq. of water, and 20 eq. of carbonic acid —

$$5(C_{12}H_{12}O_{12}) = 4(C_{10}H_{12}O_2) + 12HO + 20CO_2$$

Other products pass over with it, *e. g.* œnanthic ether, and the œnanthic and capric acids.

AMYLENE ($C_{10}H_{10}$). This is a peculiar carbo-hydrogen which was discovered by Cahours in distilling anhydrous phosphoric acid with amylic alcohol. The alcohol simply loses two equivalents of water: thus —

$$\underbrace{C_{10}H_{12}O_2}_{\text{Amylic Alcohol.}} = \underbrace{C_{10}H_{10}}_{\text{Amylene.}} + 2HO$$

It will be seen from this constitution that it is homologous or isomeric with olefiant gas. It is also isomeric with *Valerene* ($C_{10}H_9, H$). Amylene may also be procured by distilling amylic alcohol with a concentrated solution of chloride of zinc. Various isomeric hydrocarbons, boiling at different temperatures, are thus procured; but by repeatedly distilling the educt at a low temperature, a compound is ultimately obtained of which the boiling point is between 95° and 102°.[1]

[PROPERTIES.—This liquid has a slightly alliaceous odour, somewhat resembling that of caoutchouc decomposed by heat. This is pure amylene, isomeric with olefiant gas. The density of its vapour is 2·68.

This peculiar compound has been lately brought to the notice of the profession by Dr. Snow, as a substitute for ether and chloroform in producing anæsthesia. The vapour of amylene, which is considered to be less pungent than that of chloroform, and therefore easier to breathe, was administered by Dr. Snow through his usual chloroform inhaler to four surgical patients at King's College Hospital.[1] Various operations were performed while the patients were under its influence. The amylene produced an entire absence of pain in all the cases, although the inhalation was not carried so far as to induce complete coma. The patients appeared to be in a dreaming state during the performance of the operations. There was a little mental excitement and muscular rigidity in two of the patients (men), but not more than frequently takes place under the influence of chloroform; while the recovery from the effects of the vapour was very prompt. It had been previously given by Dr. Snow in several dental operations, and it had not in any instance produced sickness. Further experience is required to determine whether it should be used as an anæsthetic in preference to chloroform.—ED.]

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[1] Dumas, *Traité de Chimie*, t. vii. p. 55.

314. ÆTHER SULPHURICUS, *L. E. D.*—SULPHURIC ETHER.

HISTORY AND SYNONYMES.—This liquid is said to have been known to Raymond Lully,[2] who lived in the thirteenth century; and to Basil Valentine,[3] in the 15th century. In 1540, Valerius Cordus[4] described the method of making it. He termed it *Oleum Vitrioli dulce.* The *Vitriolic Naphtha* (*Naphtha Vitrioli*).

NATURAL HISTORY.—It is always an artificial product.[5]

PREPARATION.—The Edinburgh and Dublin Colleges give directions for the preparation of sulphuric ether. In the Pharmacopœia of the London College, Ether is placed among the articles of the Materia Medica.

The *London College* formerly ordered of Rectified Spirit, lb. iij.; Sulphuric Acid, lb. ij.; Carbonate of Potash, previously ignited, ℥j.: pour two pounds of the spirit into a glass retort, add the acid to it, and mix. Afterwards place it on sand, and raise the heat so that the liquor may quickly boil, and the Ether pass into a receiving vessel cooled with ice or water. Let the liquor distil until some heavier portion begins to pass over. To the liquor which remains in the retort, after the heat has subsided, pour the remainder of the spirit, that ether may distil in the same manner. Mix the distilled liquors, then pour off the supernatant portion, and add to it the Carbonate of Potash, shaking them frequently during an hour. Lastly, let the ether distil from a large retort, and be kept in a stoppered vessel.

The directions of the *Edinburgh College* are as follows:—"Take of Rectified Spirit, f℥L.: Sulphuric Acid, f℥x. Pour twelve fluidounces of the spirit gently over the acid contained in an open vessel, and then stir them together briskly and thoroughly. Transfer the mixture immediately into a glass matrass connected with a refrigeratory, and raise the heat quickly to about 280°. As soon as the ethereal fluid begins to distil over, supply fresh spirit through a tube into the matrass in a continuous stream, and in such quantity as to equal that of the fluid which distils over. This is best accomplished by connecting one end of the tube with a graduated vessel containing the spirit, passing the other end through a cork fitted into the matrass, and having a stopcock on the tube to regulate the discharge. When forty-two ounces have distilled over, and the whole spirit has been added, the process may be stopped. Agitate the impure ether with sixteen fluidounces of a saturated solution of muriate of lime, containing about half an ounce of lime recently slaked. When all odour of sulphurous acid has been thus removed, pour off the supernatant liquor, and distil it with a very gentle heat, so long as the liquid which passes over has a density not above 0·735. More ether of the same strength is then to be obtained from the solution of muriate of lime. From the residuum of both distillations, a weaker ether may be obtained in small quantity, which must be rectified by distilling gently again."

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[1] [*Medical Times and Gazette*, December 20, 1856, p. 624; also Jan. 17, 1857, p. 60; and Jan. 31, p. 125. Up to this date (Feb. 7, 1857) Dr. Snow states he has administered amylene vapour in 62 cases, and two of the patients only had suffered from sickness of a trivial kind.—ED.]

[2] Dulk, *Die Preussische Pharmakopöe übers, und erläutert*, 2 Th. S. 201, 2 Aufl. Leipz. 1830.

[3] *Ibid.*

[4] Thomson, *System of Chemistry*, vol. ii. p. 296, 7th ed. 1831.

[5] [There is reason to believe that although commonly described as an artificial product, ether is found in nature combined with acids of the formic and acetic series, $C_nH_nO_4$. These compounds are neutral ethers, and have usually a very fragrant odour. The flavour of the pine-apple, melon, and various other fruits, is considered to depend on the presence of such ethereal compounds.—ED.]

The *Dublin College* directs Sulphuric Ether to be thus prepared:—"Take of Rectified Spirit, three pints; Oil of Vitriol of commerce, eight fluidounces; Fresh burned Lime, in fine powder, one ounce: mix the acid and ten ounces of the spirit in a glass matrass, capable of holding a quart at least, and, without allowing the mixture to cool, connect the matrass with a Liebig's condenser, and, applying a sufficient heat to maintain the liquid in brisk ebullition, commence the distillation. As it proceeds, admit gradually, through a glass tube traversing the cork of the matrass, the remainder of the spirit, regulating its influx so that the boiling liquid shall maintain a constant level; and, when the entire of it has been introduced, continue the application of the heat until the contents of the matrass become black, and show a tendency to froth over. (The tube through which the spirit enters should dip by its lower extremity, where its diameter is contracted, at least half an inch beneath the surface of the liquid in the matrass; and the eduction pipe of the reservoir for the spirit, with which the exterior extremity of the glass tube is connected, should be furnished with a stopcock, to regulate the descent of the spirit. This reservoir also should be placed at least three feet above the level of the boiling liquid.) The crude ether thus obtained is to be agitated with the pulverised quicklime, and then rectified, the distillation being continued as long as the product, on being well shaken, continues to have a specific gravity lower than ·750. The resulting liquid should be preserved in a cool place in accurately stopped bottles. A fresh reservoir being attached to the further end of the condenser, and the distillation resumed, a product will be obtained which may be substituted for rectified spirit in a subsequent ether process."

THEORY OF ETHERIFICATION.—In order to convert one equivalent or 46 parts of alcohol into one equivalent or 37 parts of ether, we must abstract one equivalent or 9 parts of water.

	Carbon.	*Hydrogen.*	*Oxygen.*
1 equivalent Alcohol is composed of	4 eq.	6 eq.	2 eq.
Abstract 1 equivalent Water composed of.........	0 eq.	1 eq.	1 eq.
1 equivalent Ether	4 eq.	5 eq.	1 eq.

[Or, the change may be thus represented:—$C^4H^6O^2 = HO + C^4H^5O$. Assuming that ethyle is represented by C^4H^5, then ether is an oxide of this compound radical (AeO) and alcohol is a hydrated oxide, containing in addition the elements of one equivalent of water.—ED.]

But, though the change thus far appears very simple, there are some accessory reactions which make the theory of etherification exceedingly complicated, and about the precise nature of which chemists are not quite agreed.

That the sole or efficient cause of the conversion of alcohol into ether is not the mere abstraction of water, by the affinity of the sulphuric acid for that liquid, is proved by various circumstances, of which the following are some:[1]—

a. Water may be abstracted from alcohol by alkalies and chloride of calcium, yet nothing like ether is the result.

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[1] Brande, *Manual of Chemistry*, 5th edit. p. 1284, 1841.

β. Water passes over, during the whole process, along with the ether, with which the acid ought to combine in preference to dehydrating the alcohol.
γ. Ether is not produced by the action of anhydrous sulphuric acid on alcohol.
δ. Ether is never produced except by the aid of heat.
ε. When the oil of vitriol is mixed with rectified spirit, the saturating power of the acid is diminished.

When oil of vitriol is added to rectified spirit, a new compound is formed, which contains, besides the elements of sulphuric acid,—carbon, hydrogen, and oxygen. As this new compound reddens litmus, and forms salts with bases, it has been regarded as an acid (*Sulpho-vinic acid*;[1] *Ethereo-sulphuric acid*).[2] But as the sulphuric acid, by its union with the elements of the alcohol, has lost half its saturating power, the new compound is rather to be regarded as a supersalt (*bisulphate of the oxide of ethyle*),[3] combined with water; or as a double salt composed of sulphate of the oxide of ethyle and sulphate of water. Carbo-hydrogen is the basic constituent of this salt, which, by the action of heat, is resolved into ether, sulphuric acid, and water. On the ethyle hypothesis, so ably advocated by Liebig, the following is an explanation of the changes attending the formation of ether:—

Alcohol is regarded as a hydrate of the oxide of ethyle, and its equivalent is assumed to be 46. On the addition of oil of vitriol, two equivalents or 80 parts of anhydrous sulphuric acid combine with one equivalent or 37 parts of oxide of ethyle (*ether*), contained in the alcohol, and form one equivalent or 117 parts of bisulphate of oxide of ethyle (*bisulphate of ether*). The water of the alcohol and of the oil of vitriol unites with the bisulphate. By the heat which is subsequently applied to the mixture, the hydrated bisulphate is resolved into ether, water, and sulphuric acid:—

> "If we consider each particle of the [hydrated] bisulphate of oxide of ethyle as composed of ether [oxide of ethyle], anhydrous sulphuric acid, and water, it is clear that the anhydrous acid, at the moment of its separation from the ether, must seize on all water, free or combined, in the vicinity of the ether. Thus, at the moment the ether becomes free, the anhydrous acid, also set free, prevents it from uniting with water to form alcohol. But when the gaseous ether passes through the undecomposed hydrated bisulphate of oxide of ethyle, a certain proportion of the water of that compound must evaporate in the dry gas; and in these circumstances the ether and water do not combine together. The surface of the effervescing liquid has the temperature at which [hydrated] bisulphate of oxide of ethyle is decomposed; but at this temperature, 284°, the water of that compound is gaseous. There are thus produced, simultaneously, water in the gaseous form by evaporation, and ether, also gaseous, by decomposition; which, as both are in the nascent state, unite to form alcohol. Thus the alcohol, always observed to distil over with the ether, is derived from the surface; and the ether and water, which distil over, proceed from the decomposition in the interior of the liquid. This explains why no ether is obtained when the liquid is not in brisk ebullition, no matter how high the temperature may be; it explains further, why more alcohol is obtained when a current of dry air passes through the liquid, since in that case the same decomposition goes on in the interior of the liquid as generally occurs at the surface."[4]

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[1] Hennell, *Phil. Trans.* 1826 and 1828.

[2] Liebig, in the *Handwörterbuch der reinen und angewandten Chemie*, von Dr. J. Liebig und Dr. T. C. Poggendorf, Bd. i. S. 114, Braunschweig, 1837.

[3] Liebig, in Turner's *Elements of Chemistry*, 7th edit. p. 837 et seq. 1840.

[4] Ibid. p. 841.

During the distillation of ether the relative proportions of the ingredients are constantly varying; for the absolute quantity of hydrated bisulphate of ethyle is continually diminishing, and thereby the relative quantity of oil of vitriol is increasing. In consequence of this, the boiling point of the liquid gradually rises. When it arrives at about 320°, new reactions take place between the oxide of ethyle and the sulphuric acid. The principal products of these reactions are sulphuric acid, olefiant gas, water, and carbon; but these are not the only products. In certain proportions of the ingredients, acetic acid [$C^4H^3O^3$] is formed. "With a great access of [sulphuric] acid, traces of formic acid [$C^2H^1O^3$] and carbonic oxide are produced. As long as olefiant gas comes off, carbonic acid cannot be detected. During this decomposition, sulphurous acid and olefiant gas are given off in equal volumes." "Carbon and water are the elements of acetic acid, the formation of which must diminish the quantity of carbon in the residue. By the action of the sulphuric acid in excess on acetic acid, formic acid and sulphurous acid are formed; and by the action of the sulphuric acid in excess on formic acid, carbonic oxide gas is produced."[1] It is probable that in this decomposition the elements of sulphuric acid and of ether first arrange themselves so as to form ethionic [$4SO^3,C^4H^5O$] or isethionic [$S^2O^5,C^4H^5O^2+aq.$] acids." A small quantity of Light Oil of Wine is also produced. In the directions for the preparation of ether given by the London College, the process is directed to be stopped when some "heavier portion" begins to pass over. This heavier liquid is an aqueous solution of sulphurous acid. On the small scale ether may be readily made in a tubulated glass retort, connected by Liebig's condensing tube, with a cooled glass receiver. At Apothecaries' Hall, London, it is made in a leaden still, having a pewter head connected by about six feet of tin pipe with a very spacious condensing worm, duly cooled by a current of water; the receivers are of pewter with glass lids, and have a side tube to connect them with the delivering end of the worm-pipe. The still is heated by high-pressure steam carried through it in a contorted leaden pipe. A tube enters the upper part of the still for the purpose of suffering alcohol gradually to run into the acid.[2]

Mitscherlich[3] has shown how a given quantity of oil of vitriol may be made to convert an unlimited quantity of alcohol into ether; the whole of the alcohol which enters the retort passing off as ether and water. As, however, ether is usually prepared from hydrated alcohol (rectified spirit), the superfluous water gradually dilutes the acid until ultimately it becomes too dilute to effect the conversion of alcohol into ether. The process of the Edinburgh Pharmacopœia is an imitation of Mitscherlich's principle. [According to this chemist, ether is produced only so long as the liquid has a temperature between 284° and 302°.] The *rectification* of ether is intended to free it from alcohol, water, sulphurous acid, and oil of wine. It may be effected by the addition of carbonate of potash and re-distillation. In order to separate alcohol from ether, the readiest method is to shake the ether with twice its bulk of water; then pour it off, and remove the water, which the washed ether has dissolved, by adding some fresh burned lime, or fused chloride of calcium, and distilling the ether a second time.

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[1] *Liebig, op. supra cit.*

[2] Brande's *Manual of Chemistry*, 5th edit. p. 1275, 1841.

Lehrbuch der Chemie, Band. i. S. 98, 2te Aufl. Berlin, 1833.

PROPERTIES.—At ordinary temperatures ether is a colourless, very limpid liquid, having a penetrating, peculiar, though somewhat fragrant odour; a hot, pungent taste; and a high refractive power. It is a bad conductor of electricity. According to Liebig, it may be frozen at 46° below zero. The sp. gr. of pure ether at 68° F. is, according to Dumas and Boullay, 0·713. The ether of the shops contains a little alcohol, and its sp. gr. varies from 0·733 to 0·765; in the London Pharmacopœia its sp. gr. at 62° F. is fixed at 0·750. Ether is extremely volatile: when of sp. gr. 0·720, its boiling point (the mercury in the barometer standing at 30 inches) is about 98° F. In a vacuum, it boils at 40° F. below zero. The evaporation of ether causes intense cold; [and the greatest degree of cold yet produced = —166°, has resulted from the admixture of ether with solid carbonic acid.—ED.] The sp. gr. of ether-vapour was found, by Gay-Lussac, to be 2·586. Pure and recently prepared ether possesses neither acid nor alkaline properties; but, by exposure to air and light, it absorbs oxygen, by which acetic acid and water are produced. The acetic acid is not immediately observed, because it combines with some undecomposed ether to form acetic ether.[1] Ether is very combustible: it burns in atmospheric air with a yellowish-white flame, and forms carbonic acid and water. Its vapour, mixed with oxygen or atmospheric air, forms a violently explosive mixture. One volume of ether vapour consumes, in burning, six volumes of oxygen gas: the products are, four volumes of carbonic acid, and five volumes of aqueous vapour. By the slow combustion of ether vapour, by means of a coil of platinum wire, acetic, formic, and lampic [aldehydic] acids are produced.

Ether is sparingly soluble in water: nine volumes of the latter dissolve one of the former. Ether, which has been washed with water, contains a small portion of this liquid, from which it may be separated by distillation with chloride of calcium. Alcohol dissolves ether in all proportions. Ether abstracts perchloride of mercury, perchloride of gold, bichloride of platina, and the sesquichloride of iron, from their watery solutions. It readily dissolves bromine and iodine; but the solutions, by keeping, undergo decomposition. It sparingly dissolves sulphur and phosphorus: the ethereal solution of phosphorus is luminous in the dark, when poured on hot water. It dissolves the volatile oils, most of the fatty and resinous substances, some of the vegetable alkalies, urea, osmazome, gun cotton (forming *collodion*), and caoutchouc. [It is recommended by M. Stas as the best solvent for the separation of the alkaloids, morphia, strychnia, &c. in medico-legal analysis.]

CHARACTERISTICS.—Sulphuric ether may be recognised by its combustibility, its yellowish-white flame, its volatility, its peculiar odour and taste, its complete solubility in alcohol, and its sparing solubility in water, in consequence of which, when mixed with its volume of water and agitated in a phial, the mixture speedily separates, on standing, into two layers. It dissolves most resins: — the solutions, evaporated on the surface of water, leave a resinous film.

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[1] [Ether which has been kept some time in contact with air is not only acid, but possesses the property of bleaching sulphate of indigo. This is ascribed to the presence of ozone.—ED.]

COMPOSITION. — The following is the elementary composition of ether: —

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Dumas & Boullay.*
Carbon	4	24	64·87	63·05
Hydrogen	5	5	13·51	13·85
Oxygen	1	8	21·62	21·24
Ether	1	37	100·00	100·14

Chemists are not agreed as to the manner in which these elements are associated. Ether has been considered, at different times, as a *dihydrate of olefiant gas*, — a *hydrate of etherine*, — or as the *oxide of ethyle* (ethereum).[1]

2 eq. olefiant gas	28	1 eq. etherine	28	1 eq. ethyle	29
1 eq. water	9	1 eq. water	9	1 eq. oxygen	8
1 eq. Dihydrate of Olefiant Gas	37	1 eq. Hydrate of Etherine	37	1 eq. Oxide of Ethyle	37

In this table olefiant gas is regarded as a $\frac{2}{2}$ carbo-hydrogen, etherine as a $\frac{4}{4}$ carbo-hydrogen, and ethyle as $\frac{4}{5}$ carbo-hydrogen.

[ETHYLE.—$C^4H^5 = Ae$. This compound radical has been obtained in a separate state by Dr. Frankland. He procured it by the action of zinc at a high temperature on iodide of ethyle $C^4H^5I + Zn = ZnI + C^4H^5$. During this change a portion of the ethyle is lost partly by combination with zinc and partly by decomposition. It is a colourless and inflammable gas, having a faint ethereal smell, burning with a bright white flame. Its sp. gr. is 2·0039. At 32° and below this temperature it remains gaseous at ordinary pressure; but when submitted to a pressure of 2·25 atmospheres, it is condensed at 37° into a colourless transparent and mobile liquid. Its boiling point is about 23°.

The *Iodide of Ethyle* has been used medicinally, and it is said that by means of this agent a much larger quantity of iodine can be introduced into the system than where a mineral iodide, such as the iodide of potassium, is employed. According to Dr. Edwards, the iodide of ethyle may be most readily prepared by adding phosphorus cautiously to a mixture of alcohol and iodine, and distilling at a gentle heat. The product is received into water, and then agitated with more water, from which the heavy oily ether separates on standing. This is redistilled with oxide of lead and chloride of calcium, until the product is free from phosphorus and water.—ED.]

[ETHER FROM METHYLATED SPIRIT.—In the production of ether, methylated spirit, a mixture of rectified spirit and pyroxylic spirit, containing ten per cent. of the latter compound, has been substituted for the alcohol ordinarily used. It becomes a question whether the product is really sulphuric ether or a mixture of this with methyle ether. Mr. Macfarlan, who has accurately compared the products, states, that in odour, flavour, and general properties, they are the same, or so similar, that no clear distinction can be made. Methyle and Ethyle are compound radicals of the respective ethers, consisting of carbon and hydrogen. *Methylic ether* is a colourless liquid of a peculiar ethereal smell, and liquid only at a temperature of from 22° to 40°. It is more volatile than the corresponding product from alcohol. The boiling point of pure ether at 60° is 96°,—of ether prepared from methylated spirit at the same density, 80°. Hence this difference in the boiling point may serve to indicate whether a specimen of sulphuric ether is or is not mixed with methylic ether. Methylic ether, being a gas at ordinary temperatures, escapes rapidly from the compound.

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[1] See page 461.

Wishing to ascertain whether the physiological effects of this ether differed from those of common ether, Mr. Macfarlan made himself the subject of some experiments. He says: "having first taken the ordinary ether from alcohol, to ascertain its effects, I took doses of the ether from methylated spirit, varying from ʒss. to ʒiij., and found the effects to correspond so nearly with those of ether, as to be unable to note any difference between them; the pulse remained unchanged, about 80, and the odour given to the breath was precisely that of ether, and of ether alone. No trace of the ordinary flavour of pyroxylic spirit was perceptible, and the effects were those of ether alone. The effects of a dose of three fluidrachms were, as might have been expected, more powerful; the pulse was slightly quickened, the heat of the skin a little augmented, and the odour of ether in the breath continued for a longer period; but there was no other effect perceptible. There was no pain of the head, no tinnitus aurium, no tendency to nausea, nor any unpleasant symptom whatever."[1] In the opinion of this gentleman, the ether obtained from methylated spirit is as safe and useful as ether obtained from alcohol. It is, however, desirable that more extensive trials should be made before we adopt the conclusion that this ether may be safely and universally substituted for that which has been hitherto used.

The effects of the *vapour* when respired have not been hitherto investigated. We have met with cases in which there was a strong probability that nausea, loss of appetite, and vertigo were the results of the inhalation of the vapour of methylated spirit diffused through the air; and we know of no facts to show that the vapour of methylic ether can be breathed with the same degree of safety and impunity as that of ordinary ether.—ED.]

PURITY.—The ether of commerce is usually contaminated with small quantities of either spirit or water, or both. These augment its sp. gr., but do not much affect its medicinal properties. The London College states that its sp. gr. should not exceed 0·750; but this is too high. The Edinburgh College fixes it at 0·735, or under. I think 0·740 would be sufficiently low. Ether which contains no alcohol does not coagulate the serum of the blood. Pure ether does not redden litmus, but the ether of the shops usually does so slightly, either from being imperfectly prepared, or from having been too long kept.[2] Ten fluidounces of water should not dissolve more than one fluidounce of ether, and the solution should be quite transparent. It should speedily and totally evaporate in the air. It should not become milky when mixed with water. "When agitated in a minim measure, with half its volume of concentrated solution of muriate of lime, its volume is not lessened."—*Ph. Ed.*

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[1] *Pharmaceutical Journal*, vol. xv. p. 313.

[2] See note at page 464.

PHYSIOLOGICAL EFFECTS. AS A LIQUID. *a. On Vegetables.*—Ether, like alcohol, acts as a powerful and rapid poison to plants.

β. On Animals.—The effects of it on dogs have been determined by Orfila,[1] who found that half an ounce introduced into the stomach, and the œsophagus tied, caused attempts to vomit, with diminished muscular power, insensibility, and death in three hours. Three drachms and a half injected into the cellular tissue of the thigh caused death on the fourth day. Jäger[2] found that half an ounce of ether acted as a fatal poison to a crane: at the end of forty-eight hours its odour could be readily detected in the body. He made similar experiments with pigeons and ducks. One of the last-mentioned animals took altogether an ounce of ether, yet was not dead at the end of twenty-four hours.

γ. On Man.—The operation of ether is analogous to that of alcohol, but is much more rapid and transient. *Swallowed in moderate doses* it makes a powerful impression on the mouth, throat, and stomach; allays spasm, and relieves flatulence; but, according to some observers, it augments neither the heat of the body nor the frequency of the pulse.[3] Its first effects on the cerebral functions are those of an excitant, but the subsequent effects are those of a depressing agent. *In somewhat larger doses* it produces intoxication like that caused by alcohol. *In excessive doses* it occasions nausea, a copious flow of saliva, giddiness, and stupefaction. The long and habitual use of ether diminishes the effect of this substance over the system, and, therefore, the dose must be proportionately increased. Dr. Christison mentions the case of an old gentleman who consumed sixteen ounces every eight or ten days, and had been in the habit of doing so for many years. Yet, with the exception of an asthma, for which he took the ether, he enjoyed tolerable health. The chemist, Bucquet, who died of scirrhus of the colon, with inflammation of the stomach and of the intestines generally, took, before his death, a pint of ether daily, to alleviate his excruciating pains.[4]

MODUS OPERANDI.—When ether is swallowed, it is rapidly absorbed, and subsequently thrown out of the system by the pulmonary exhalants. Magendie[5] says, that ether introduced into the cavity of the peritoneum is discoverable in the expired air by its odour. Thrown into the cavity of the pleura, it produces speedy death, and its odour is very obvious when we approach the mouth of the animal.[6] In the case of a man poisoned by laudanum, and to whom before death half an ounce of spirit of sulphuric ether was given, the ether was detected by its odour in the brain.[7] [Its operation on the blood is similar to that of alcohol. It tends, when absorbed and diffused, to arrest oxidation. See *ante*, p. 449. —ED.]

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[1] *Toxicol. Gén.*

[2] Wibmer, in *Die Wirkung*, &c.

[3] Schwilgué, *Traité de Mat. Méd.* 1818; also Trousseau and Pidoux, *Traité de Thérap.* 1836.

[4] Mérat and de Lens, *Dict. Mat. Méd.*

[5] *Elem. Compend. Physiol.* by Milligan.

[6] *Lectures on the Tissues*, in *Lancet*, Nov. 22, 1834.

[7] *Lancet* for 1836–7, vol. i. p. 271.

USES.—Ether is employed both medicinally and for pharmaceutical and surgical purposes. [It may be used as a liquid or in the state of vapour.]

1. *MEDICINAL USES.* *α. Internal.*—Ether is principally valuable as a speedy and powerful agent in spasmodic and painful affections not dependent on local vascular excitement, which are accompanied by a pale, cold skin, and a small, feeble pulse. If administered during a paroxysm of spasmodic asthma, it generally gives relief, but has no tendency to prevent the recurrence of attacks. In cramp of the stomach, singultus, and flatulent colic, its happy effects are well established.[1] It is sometimes highly advantageous in a paroxysm of angina pectoris. During the passage of urinary or biliary calculi, it may be used as a substitute for, or in combination with, opium, to overcome the spasm of the ducts or tubes through which the calculus is passing. In the latter stages of continued fever, ether is sometimes admissible. It is employed to relieve the subsultus tendinum and hiccup. Desbois de Rochefort[2] administered it in intermittent fevers. He gave it about half an hour before the expected paroxysm; it acted as a mild diaphoretic, and prevented the recurrence of the attack. Headache of the kind popularly called nervous, that is, unconnected with vascular excitement, is sometimes speedily relieved by ether. I have found it beneficial principally in females of delicate habits. In such it occasionally gives immediate relief, even when the throbbing of the temporal vessels and suffusion of the eyes (symptoms which usually contra-indicate the employment of ether) would seem to show the existence of excitement of the cerebral vessels.

In flatulence of the stomach it may be taken in combination with some aromatic water. Against sea-sickness it should be swallowed in a glass of white wine. Durande[3] recommends a mixture of three parts ether and two oil of turpentine, as a solvent for biliary calculi. Bourdier[4] employed ether to expel tape-worm. He administered it, by the stomach and rectum, in an infusion of male fern, giving a dose of castor oil an hour after. In faintness and lowness of spirits, it is a popular remedy. In poisoning by hemlock and mushrooms, it has been employed.[5] In asphyxia it has been used with benefit.

β. External.—The principal external use of ether is to produce cold by its speedy evaporation. Thus, in strangulated hernia, it may be dropped on the tumour and allowed to evaporate freely: by this means a considerable degree of cold is produced, and, in consequence, the bulk of the part diminished, whereby the reduction of the hernia is facilitated. Dropped on the forehead, or applied by means of a piece of thin muslin, ether diminishes vascular excitement, by the cold produced from its evaporation, and is exceedingly efficacious in headache and inflammatory conditions of the brain. In burns and scalds it may also be employed as a refrigerant. If its evaporation be stopped or checked, as by covering it with a compress, it acts as a local irritant, causing rubefaction, and, by long-continued application, vesication. It is used with friction as a local stimulant.

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[1] On the Effects of Ether in Spasmodic Affections of the Stomach, and in Intermittents. See *Medical Facts and Observations*, vol. v. Lond.

[2] *Cours Elém. de Matière Médicale*, Paris, 1789.

[3] *Observ. sur l'Efficacité du Mélange d'Ether sulphuriq. et d'Huile volatile du Téréb. dans Coliques hépatiq. produites par des Pierres Biliaires*, Strasburg, 1790.

[4] *Mém. de la Société de Méd.*

[5] J. Frank, *Toxicologie*, S. 70, 108.

2. *PHARMACEUTICAL USES.*—Ether is employed in the preparation of the Compound Spirit of Sulphuric Ether. Ether, or its alcoholic solution, is also used to extract the active principles of certain drugs, as of Lobelia, Aloes, Musk, &c. The solutions are called Ethereal Tinctures (*Tincturæ Ethereæ*), or by the French pharmacologists *Ethéroles.* These may be conveniently prepared by percolation. Ether is of assistance in determining the purity of some medicinal substances, as of Aconitina and Veratria, which are very soluble in it. It is employed in toxicological researches, to remove perchloride of Mercury, as well as Strychnia, Morphia, and other alkaloids, from organic mixtures and from their concentrated aqueous decoctions. [A solution of gun-cotton or xyloidine in ether is well known and extensively employed in pharmacy under the name of *Collodion.*—ED.]

ADMINISTRATION.—It may be given in doses of from fʒss. to fʒij.: —a tea-spoonful is the ordinary quantity. This dose may be repeated at short intervals. It is usually exhibited in some aromatic water, and frequently in combination with other antispasmodics and stimulants, as ammonia, or valerian. "It may be perfectly incorporated with water, or any aqueous mixture, by rubbing it up with spermaceti employed in the proportion of two grains for each fluidrachm of the ether."[1]

ANTIDOTES.—In cases of poisoning by ether, the same treatment is to be adopted as already recommended in cases of poisoning by alcohol.

1. **SPIRITUS ÆTHERIS SULPHURICI**, E.; *Spirit of Sulphuric Ether.* (Sulphuric Ether, Oj.; Rectified Spirit, Oij. Mix them. The density of this preparation ought to be 0·809. "It does not affect litmus paper, or render water muddy: when agitated with twice its volume of a concentrated solution of muriate of lime, 28 per cent. of ether separates by rest.")—Its medicinal properties are similar to, though somewhat less powerful than, those of ether, over which it has the advantage of being miscible with water in all proportions. The dose of it is fʒj. to ʒiij. mixed with some diluent. It is used in the preparation of the *Tinctura Lobeliæ ætherea,* E.

2. **SPIRITUS ÆTHERIS COMPOSITUS**, L.; *Compound Spirit of Sulphuric Ether.* (Sulphuric Ether, f℥viij.; Rectified Spirit, f℥xvj.; Ethereal Oil, fʒiij. Mix.)—This preparation is commonly called *Hoffmann's Mineral Anodyne Liquor* (*Liquor Anodynus mineralis Hoffmanni*); being made in imitation of a prescription described by Hoffmann,[2] which it is said he was taught by an apothecary of the name of Martmeier.[3] This preparation is sometimes employed as an adjunct to laudanum, to prevent

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[1] *United States Dispensatory*, 3d edit. p. 727, Philadelphia, 1836.

[2] *De Acido Vitrioli Vinoso*, 1732. Fr. Hoffmanni *Operum omnium Supplementum*, p. 855, Genevæ, 1754.

[3] Voigtells, *Vollständiges System der Arzneymittellehre*, Bd. ii. 3tte Abt. S. 38, Leipzig, 1817.

the nausea which the latter excites in certain habits. Its dose is from f℥ss. to f℥ij. in any proper vehicle.

[3. **ÆTHER ALCOHOLICUS**, Pharm. Norveg.; *Alcoholic Ether.* (Sulphuric Ether, ℥j.; Alcohol, (·833) three ounces.)—This differs from the former compound in containing no ethereal oil and a larger proportion of alcohol. Its uses are the same.

4. **ÆTHER ALCOHOLICUS CAMPHORATUS**, Pharm. Norveg.; *Camphorated Alcoholic Ether.* (Camphor, sliced, ℥j.; Alcoholic Ether, ℥vj. Dissolve.) —ED.]

[**ETHER-VAPOUR.**—Ether vapour had been employed medicinally, as described by the author in the previous edition of his work, in the treatment of spasmodic asthma, chronic catarrh, dyspnœa, and hooping-cough; but in the course of the year 1846, the remarkable discovery was made that this vapour might be safely employed as an anæsthetic in surgical operations.

HISTORY.—On the 30th Sept. 1846, Dr. Morton, a dentist of Boston, U. S., caused a patient to inhale the vapour of ether. This patient passed into a state of unconsciousness resembling sleep, during which a molar tooth was extracted without any indication of feeling on his part. No unpleasant effects followed. It appears that this discovery was not the result of mere accident. Dr. Morton had long entertained the idea of administering something to his patients which should have the effect of destroying pain in dental operations; and with this view he had consulted Dr. Jackson, a chemist of Boston. This gentleman alleges that he first communicated the fact that sulphuric ether would answer the purpose, Dr. Morton being ignorant of the properties of this liquid. On this latter point the parties are at issue: "*non nostrum est tantas componere lites.*" On the 10th October, ether-vapour was first used in the excision of a tumour by Dr. Warren at the Massachusetts Hospital. The operation lasted seven minutes, and the patient was entirely unconscious during its performance.[1] The nature of the agent employed was not, however, communicated to the profession, or even to the operator, until after the performance of this operation. It was then used in private and general practice; and on the 18th November, Dr. Bigelow, one of the surgeons of the hospital, published, in the Boston Medical and Surgical Journal, a report of the effects of the new agent. This was the first medical publication on etherization whereby the news of the discovery was promulgated to the world.

Within six weeks of the publication of this paper, ether-vapour had been employed in the London hospitals, and in less than three months it was introduced into the hospitals of Paris. It enjoyed considerable popularity; and in spite of some accidents which followed its administration it was very extensively used, until Dr. Simpson proposed the substitution of chloroform vapour for that of ether, in a paper read before the Medico-Chirurgical Society of Edinburgh, on the 1st December, 1847. Since this period, the preference, as an anæsthetic, has been given to chloroform.

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[1] See *Transactions of American Medical Association*, vol. i. p. 180, 1848.

MODE OF ADMINISTRATION.—The vapour is most safely administered by an inhaler, such as that which has been contrived by Dr. Snow;[1] but according to Dr. Warren, who continued to employ ether by preference after the discovery of chloroform, the following simple process is all that is required. A large excavated sponge is saturated with ether: this is applied to the nostrils of the patient, the face having been previously oiled or anointed to protect it from the irritant action of the liquid. In private practice, especially among females and children, a towel is used folded in the form of a funnel with a small sponge saturated with ether placed in its cavity. The patient is placed in the horizontal or upright posture—the former being preferred; and it is desirable that much food should not be taken shortly before the administration. The narcotic effect is produced in from three minutes and upwards: the average period is in about five minutes. Dr. Snow correctly observes, that the period for complete insensibility must vary with the activity and depth of the respiration, but it seldom exceeds two to three minutes in a child, or four to five minutes in an adult, unless the vapour is very much diluted.

DOSE.—Dr. Snow has found that the quantity of ether which is required to produce complete insensibility is usually from six drachms to one ounce in the adult; and in children in the same proportion according to their size. The quantity required to keep up insensibility during the operation is seldom greater than that which induced the state of etherization.[2] The size of the patient is the only circumstance which appears to influence the dose, *i. e.* the quantity required to produce insensibility when the inhalation goes on steadily. If the inhalation be interrupted, more ether is required, as the process of inhalation must be recommenced. Females generally consume a smaller quantity of ether than males. Hard drinkers do not require more ether to make them insensible than those persons who are temperate.

EFFECTS.—*Etherization and its Stages.*—Although the general effects produced by the inhalation of ether are in most cases similar, yet peculiarity of temperament and particular states of the system have an important influence over the nature and progress of the symptoms. On these points the report of the Committee appointed to inquire into the effects of this agent by the American Medical Association, affords us valuable information, untainted with any prejudice for or against the use of the vapour.[3] While in most individuals inhalation will produce calmness, repose, and sound sleep, placing the patient in a condition favourable for operative procedures; in others, although administered in the same way, the vapour will produce high nervous excitement, great restlessness, and even convulsions, rendering it necessary to postpone the projected operation. Although the general effect is to destroy the sense of pain, instances occasionally happen where it is impossible to produce this result in justifiable doses; while there are other cases in which a very small quantity will produce a degree of unconsciousness not to be attained at all in the cases referred to. In some instances pain will be annulled by ether, while the intellectual faculties and even the sense of touch will be preserved; the patient is aware of what is passing—can express his wishes—and can feel the movements of the surgeon, and yet the sense of pain is obliterated; while in others the full effects of the vapour carried to the point of entire unconsciousness, is necessary to destroy the pain. *Vomiting* occurs as an accompaniment of etherization in a considerable number of cases, while in others it is absent. The condition of the circulation (*the pulse*) varies also; generally, in the earlier stages, the circulation is quickened and the pulse becomes more slow as the impression of the ether deepens; while in other cases it is either slower from the first or continues rapid through the whole process. When etherization has been carried to its full extent, the phenomena are perhaps more uniform. At this point the muscles become relaxed, the breathing is deep, slow, and stertorous; the eyes are turned up, and the countenance is devoid of expression as in sound sleep. The pupil is not much altered from its natural state, and, according to Dr. Snow, it remains more or less sensible to light in all stages of etherization. The eyelids are sensible in the early stage, but lose their sensibility in the more advanced stages of etherization. Sometimes the features are so relaxed as to exhibit the peculiar expression of idiocy or drunkenness. It is in this stage which, to those unaccustomed to it, is somewhat alarming, that the patient remains perfectly passive under every kind of operation, the muscles being in a perfect state of relaxation.

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[1] *On the Inhalation of the Vapour of Ether*, 1847, p. 15.

[2] *Op. cit.* pp. 29, 85.

[3] *Trans. of Amer. Med. Assoc.* vol. i. p. 184.

Dr. Warren observes:—"The phenomena are pretty uniform. There is at first a little struggling and coughing, and some resistance on the part of the patient from the irritant effects of the vapour. In a minute or two contractions of the limbs begin, which are often so violent as to require some degree of restraint. At the end of three or four minutes, the muscles are relaxed, and the operation may then be commenced. In an old dislocation, the etherised state was once maintained for an hour."

Dr. Snow divides the effects of ether into five stages or degrees. It is in the fourth degree that all the muscles are relaxed. The eyelids fall over the eyes or remain as they are placed by the fingers. The snoring breathing also commences at this stage, and this, in his opinion, is an indication of the anæsthetic state of the patients.[1]

MODUS OPERANDI.—The vapour of ether when introduced into the blood probably acts like that of alcohol, *i. e.* in arresting those oxidation changes on which the manifestation of nervous power depends.[2]

DANGERS OF ETHERIZATION.—In some cases the inhalation of the vapour has produced convulsions more or less severe and protracted, prolonged stupor, great cerebral excitement, alarming and long-continued depression of the vital powers, and asphyxia. As secondary effects, bronchitis, pneumonia, congestion, and inflammation of the brain have been attributed to the inhalation of the vapour. In other cases, either from improper administration or idiosyncrasy, it has proved fatal to life. Dr. Warren, who may be regarded as a strong advocate of the use of this vapour, informs us that it had been employed in his hospital in more than a thousand cases, and very largely in private practice, without any unfavourable result. At the same time he expressed himself as not feeling confidence in an uninterrupted immunity from serious accidents. Experience was on the whole, in this country, favourable to its use. It had been used at St. Bartholomew's Hospital in at least two thousand cases without injury or accident.[1] Notwithstanding these facts the vapour is now rarely employed as an anæsthetic. Chloroform is universally selected. The reasons which have led to this preference will be a subject for consideration hereafter.

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[1] *Op. cit.* p. 8.

[2] See ALCOHOL, *antè*, p. 449.

There is some reason to believe that on the first introduction of ether-vapour as an anæsthetic, the cases in which it caused serious or fatal results were not so freely published as those in which it had proved beneficial. The deaths were assigned to other causes. At an early period, M. Jobert, of the Hospital of St. Louis, met with two instances in which there was reason to believe that the inhalation had caused death. Mr. Nunn reported one fatal case after an operation for lithotomy;[2] and others will be found in the volume of the journal referred to. At the same time, it must be admitted that the deaths have been few compared with the large number of cases in which the vapour has been administered.

USES. *In cases of Insanity.*—Ether vapour has been used in cases of insanity attended with much excitement. The effect has been only a temporary diminution of the excitement. In twelve cases, chiefly recent and characterised by considerable excitement, it thus produced temporary relief. In one instance it disposed the patient to take food which she had resisted before. It thus prevented the necessity of using the feeding-tube.

In another case with suicidal and homicidal disposition accompanied by great restlessness, it was given every night at bed-time for about three weeks, with the effect of always procuring a quiet night.[3] In 1847 it was administered to sixteen patients in the Utica Asylum. A few were highly excited by it; several seemed intoxicated, and said that they felt as if drunk; one rested remarkably well the next night; two experienced no effect of any kind from it; some were decidedly improved by it, becoming more active, cheerful, and sociable.

It has been used in obstetric practice, in *parturition;* in cases of *hydrophobia, tetanus, facial neuralgia, tic-douloureux*, and other nervous diseases. In these last-mentioned cases the effects, if any, consisted only in a temporary alleviation of the symptoms. Dr. Willis has found it of great service in spasmodic diseases of the respiratory organs, and especially valuable in cutting short the severe paroxysms of *hooping-cough*.[4] It has also been employed successfully in cases of *strangulated hernia* for the reduction of the hernia.—ED.]

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[1] Letter of Mr. Lawrence to Dr. Warren, *Trans. Amer. Med. Assoc.* vol i. p. 185.

[2] *Medical Gazette*, vol. xxxix. p. 414. See also, for other cases, the same vol. pp. 563, 585, 613, and 631.

[3] Cases communicated by Dr. Ray, *Trans. Amer. Med. Assoc.* vol. iii. p. 79. See also *Medical Gazette*, vol. xxxix. p. 878.

[4] *Medical Gazette*, vol. xxxix. p. 271.

315. OLEUM ÆTHEREUM, *L.*—ETHEREAL OIL.

(Spiritus ætheris oleosus, *D.*)

HISTORY AND SYNONYMES.—This liquid is commonly termed *heavy oil of wine*, or simply *oil of wine*. Dumas[1] says it was known to Paracelsus, who designated it *sweet oil of vitriol*. Modern writers have given it various appellations founded on its supposed composition. Thus, according to Mr. Hennell,[2] it is a *sulphate of hydrocarbon*,—Dumas[3] calls it *sulphatic ether*,—others a *double sulphate of ether* and *hydrocarbon*,—while Liebig[4] terms it *sulphate of oxide of ethyle and Etherole.*[5]

PREPARATION.—The following directions for procuring it are given in the *London Pharmacopœia*:—

> "Take of Rectified Spirit, lb. ij.; Sulphuric Acid, lb. iv.; Solution of Potash, Distilled Water, of each f℥j.; or as much as may be sufficient. Mix the acid cautiously with the spirit. Let the liquor distil until a black froth arises; then immediately remove the retort from the fire. Separate the lighter supernatant liquor from the heavier one, and expose the former to the air for a day. Add to it the solution of potash first mixed with water, and shake them together. Lastly, when sufficiently washed, separate the ethereal oil which subsides."
>
> The *Dublin College* gives the following directions for its preparation:—"Take of Rectified Spirit, one pint and a half; Oil of Vitriol of commerce, one pint and a half; Sulphuric Ether, five fluidounces: mix the oil of vitriol with one pint of the rectified spirit, in a matrass of glass, and, connecting this with a Liebig's condenser, apply heat, and distil, till a black froth begins to rise. Separate the uppermost or lighter stratum of the distilled liquid, and, having exposed it in a capsule for twenty-four hours to the atmosphere, let the residual oil be transferred to a moist paper filter, and washed with a little cold water, so as to remove any adhering acid. Let it now be introduced into a bottle containing the remainder of the spirit mixed with the ether, and dissolved."

The process of the London Pharmacopœia is that followed at Apothecaries' Hall, London. The late Mr. Hennell informed me that 33 lbs. avoird. of Rectified Spirit, and 64 lbs. avoird. of Oil of Vitriol, yielded in one operation 17 ounces avoird. of ethereal oil. There is, therefore, an immense loss in the operation.

THEORY OF THE PROCESS.—When oil of vitriol and alcohol are mixed, bisulphate of oxide of ethyle ($C^4H^5O,2SO^3$) and water are formed. Under the influence of heat the bisulphate suffers decomposition; but the reactions vary with the temperature. When the sulphuric acid is greatly in excess, and the boiling point of the liquid has attained 320° F., the principal products of the decomposition are sulphurous acid, olefiant gas (carbo-hydrogen), water, and carbon. At this period of the process heavy oil of wine is also produced in small quantity. Its formation may be accounted for by supposing that two equivalents of the bisulphate of oxide of ethyle and water react on one another, and that the carbo-hydrogen ($C^4H^4=1$ eq. Etherole) of the one is substituted for the water of the other; the products being heavy oil of wine (*oleum æthereum*, Ph. L.), sulphuric acid, and water.

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[1] *Traité de Chimie*, v. 543.

[2] *Philosophical Transactions*, 1826.

[3] *Op. supra cit.*

[4] Turner's *Elements of Chemistry*, 7th edit. pp. 844 and 861, 1841.

[5] The term *etherole* is applied to a $\frac{4}{4}$ carbo-hydrogen, better known as *Light Oil of Wine.*

The substance termed by Liebig ETHEROLE (C^4H^4) is commonly denominated *Light Oil of Wine*. It was discovered by Hennell, who calls it *Hydrocarbon from Oil of Wine*, because it is obtained by boiling the heavy oil of wine with water. It is a colourless, oily liquid of sp. gr. 0·917 to 0·920. When kept for some time at a low temperature, it deposits a crystalline matter called ETHERINE or *Camphor of Oil of Wine* (C^4H^4), which is isomeric with etherole.

PROPERTIES.—Ethereal oil is an oily liquid, having usually a yellowish tint, though when quite pure it is said to be colourless. It has a peculiar aromatic odour, and a bitter taste. Its sp. gr., according to Mr. Hennell, is 1·05; but according to Serullas it is 1·13. It boils at 540° F. It is insoluble in water, but dissolves readily in alcohol and ether. It neither reddens litmus nor precipitates a solution of chloride of barium, so that the sulphuric acid contained in it seems to be completely neutralised. According to Mr. Hennell, ethereal oil dissolves a variable quantity of a $\frac{4}{4}$ carbo-hydrogen, part of which separates in a crystalline form (*etherine*) when the oil is kept for some time, or when exposed to cold. When ethereal oil is slightly heated with water, it yields a light yellow oil (*etherole*), which floats on water, and bisulphate of oxide of ethyle, which is dissolved by the water.

CHARACTERISTICS.—Ethereal oil is recognised by its oily appearance, its peculiar odour and taste, its slight solubility in, but greater specific gravity than, water, and its solubility in ether and alcohol. If it be heated in a test-tube it yields an inflammable vapour which burns like olefiant gas, and a carbonaceous residue which contains sulphuric acid, as is proved by lixiviating with water, and testing by chloride of barium. Ethereal oil, added to a solution of chloride of barium, occasions no cloudiness; but, if we evaporate the mixture to dryness, the residue is found to contain sulphate of baryta.

COMPOSITION.—Three chemists have analysed ethereal oil, namely, Hennell, Serullas, and Liebig. The results of two only of these agree, namely, those of Liebig and Serullas.

	LIEBIG AND SERULLAS.					HENNELL.		
	Atoms.	*Eq. Wt.*	*Theory.*	*Liebig.*	*Serullas.*	*Eq.*	*Eq. Wt.*	*Per Ct.*
Sulphuric acid	2	80	55·172	55·614	55·02	1	40	38·0
Carbon	8	48	33·103	33·180	33·05	9	54	53·7
Hydrogen	9	9	6·207	5·788	6·11	9	9	8·3
Oxygen	1	8	5·517	5·418	5·49	0	0	0·0
Oleum Æthereum (Ph. L.)	1	145	99·999	100·000	99·67	1	103	100·0

It would appear from this table that Hennell[1] must have analysed ethereal oil holding in solution carbo-hydrogen (*etherine*), and that he omitted to take into calculation the elements of water which this oil contains.

According to Serullas[2] and Liebig,[3] this oil is a double sulphate of oxide of ethyle (ether) and etherole (carbo-hydrogen).

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[1] *Philosophical Transactions* for 1826, pp. 247–8.

[2] *Ann. de Chim. et de Phys.* xxxix. 153.

[3] Turner's *Elements of Chemistry*, 7th edit. pp. 844 and 861.

	Atoms.		Eq. Wt.
2 eq. sulphuric acid	2	......	80
1 eq. oxide of ethyle (ether)	1	......	37
1 eq. etherole (carbo-hydrogen)	1	......	28
1 Sulphate of Oxide of Ethyle and Etherole	1	......	145

Or,	Atoms.		Eq. Wt.
Sulphate of oxide of ethyle (ether)	1	......	77
Sulphate of etherole (carbo-hydrogen)	1	......	68
Sulphate of Oxide of Ethyle and Etherole	1	......	145

Dumas,[1] however, regards it as true sulphatic ether (SO^3,C^4H^5O), holding in solution variable quantities of carbo-hydrogen.

PHYSIOLOGICAL EFFECTS.—These have not been determined. I gave fifteen drops to a small rabbit: death took place within an hour. The symptoms were indisposition to move, apparent tendency to sleep, followed by incapability of supporting the erect position, occasional convulsive movements, grating of the teeth, and insensibility. The body was opened immediately after death: the heart was still beating, and its right cavities were gorged with purple blood. Ethereal oil, therefore, acts on the nervous system in a somewhat analogous way to ether.

USES.—Ethereal oil is used in the manufacture of the *Spiritus Ætheris Compositus* of the Pharmacopœia.

"Dr. Hare," in his *Chemical Compendium*, "reports the opinion of Drs. Physick and Dewees in favour of the efficacy of the officinal oil of wine, dissolved in alcohol, in certain disturbed states of the system, as a tranquillising and anodyne remedy."[2]

316. SPIRITUS ÆTHERIS NITRICI, *L. E.*—SPIRIT OF NITRIC ETHER, OR SWEET SPIRIT OF NITRE.

(Spiritus æthereus nitrosus, *D.*—Hyponitrous ether, with four volumes of rectified spirit, *E.*)

HISTORY.—The first traces of this preparation are to be found in the writings of Raymond Lully, in the 13th century.[3] Basil Valentine, in the 15th century, taught a much improved method of preparing it.[4] Nitric Ether was first mentioned by Kunkel, in 1681.[5] It has been known under various names, such as *Dulcified Acid of Nitre* (*Acidum Nitri dulcificatum*), *Sweet Spirit of Nitre* (*Spiritus Nitri dulcis*), *Spirit of Nitrous Ether* (*Spiritus Ætheris Nitrosi*), and *Nitre Drops*.

PREPARATION.—It is usually prepared by the action of nitric acid on rectified spirit at one operation, as in the process of the *London College*, which is that employed at Apothecaries' Hall, London. Or it may be procured by first preparing nitric [hyponitrous] ether, and subsequently diluting this with rectified spirit, as in the process of the *Edinburgh College*.

1. Preparation of Hyponitrous Ether.—Liebig[6] has lately given the following method of obtaining this compound in a state of purity:—"One part of starch, and ten parts of nitric acid, sp. gr. 1·3, are introduced into a capacious retort, which is connected by means of a wide tube, bent at right angles, with a two-necked bottle, so that the further end of the tube reaches to the bottom of the bottle. Into this bottle is introduced a mixture of two parts of alcohol at 85 p. c. and one part of water, and it is surrounded by cold water. The second aperture of the bottle is connected, by means of a long wide tube, with a good cooling apparatus or condenser. The starch and nitric acid are heated in the water-bath; pure hyponitrous acid is disengaged, which, passing through the alcohol, instantly combines with the ether, forming hyponitrite of oxide of ethyle, which distils in a continuous stream. This process is very productive. By means of water, the new ether is purified from alcohol, and by standing over chloride of calcium it is freed from water. The tube which connects the retort with the two-necked bottle must have a length of two or three feet, and must be surrounded with moist paper during the operation. If the alcohol be not carefully cooled, it becomes spontaneously hot, and boils violently. From this moment the hyponitrite of ethyle is no longer pure."

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[1] *Traité de Chimie appliqué aux Arts*, v. 545, Paris, 1835.

[2] *United States Dispensatory*.

[3] Dulk, *Die Preussische Pharmakopöe übers. und erläutert*, 2er Th. S. 704. 2te Aufl. Leipz. 1830.

[4] *Ibid.*

[5] Thomson, *System of Chemistry of Inorganic Bodies*, 7th edit. ii. 317, 1831.

[6] Turner's *Elements of Chemistry*, 7th edit. p. 848.

The process of the *Edinburgh College* for the preparation of hyponitrous ether is as follows:—Take of Rectified Spirit, Oij. and f℥vj.; Pure Nitric Acid (density 1·500) f℥vij. Put fifteen fluidounces of the spirit, with a little clean sand, into a two-pint matrass, fitted with a cork, through which are passed a safety-tube, terminating an inch above the spirit, and another tube leading to a refrigeratory. The safety-tube being filled with pure nitric acid, add through it gradually three fluidounces and a half of the acid. When the ebullition which slowly arises is nearly over, add the rest of the acid gradually, half a fluidounce at a time, waiting till the ebullition caused by each portion is nearly over before adding more, and cooling the refrigeratory with a stream of water, iced in the summer. The ether thus distilled over being received in a bottle, is to be agitated first with a little milk of lime, till it ceases to redden litmus paper, and then with half its volume of concentrated solution of muriate of lime. The pure hyponitrous ether thus obtained should have a density of 0·899.

The *theory* of Liebig's process for making hyponitrous ether is simple. Starch deoxidises nitric acid and evolves hyponitrous acid [the nitrous acid of Graham and continental chemists]. This being conveyed into alcohol, combines with the oxide of ethyle of the latter, and disengages the water.

Hyponitrous ether is, however, usually prepared by the action of nitric acid on alcohol; as in the Edinburgh and Dublin processes. The reactions are then more complicated, but vary with the strength of the acid and the temperature. They essentially depend on the deoxidation of the nitric acid by the hydrogen and carbon of the ethyle of part of the alcohol. As hydrogen has more affinity for carbon than oxygen, it follows that in the earlier stages, and when reaction is moderate, it is the hydrogen of the ethyle which is oxidised by the oxygen of the nitric acid. Thus, when we employ a dilute acid, or moderate the reaction by cold, the products are aldehyd (hydrated oxide of acetyle[1]), water, and hyponitrous ether. When, however, the reaction is more energetic, as when strong nitric acid is employed, and the temperature is not moderated, the carbon as well as the hydrogen of the ethyle is oxidised by the oxygen of the acid, and several products, besides those above mentioned, are then obtained. Carbonic (CO^2) and oxalic (C^2O^3) acids are formed by the oxidation of the carbon. Acetic ($C^4H^3O^3$) and formic (C^2HO^2) acids are also generated; "besides acetate and formiate of ethyle" (Liebig). By the deoxidation of nitric acid there are obtained, besides hyponitrous acid already mentioned, nitrous acid, binoxide of nitrogen, protoxide of nitrogen, and nitrogen (Thénard).

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[1] *Acetyle*, and the *oxide of acetyle*, are hypothetical substances. Aldehyd is regarded as the hydrate of the hypothetical oxide of acetyle.

2. Preparation of Spiritus Ætheris Nitrici.—The processes of all the British Colleges differ from each other.

The *London College* orders of Rectified Spirit, lb. iij.; Nitric Acid, ℥iv. Add the Acid gradually to the Spirit, and mix; then let 32 fluidounces distil.

The *Edinburgh College* directs the pure hyponitrous ether (obtained by the process above detailed) to be mixed with the remainder (*i. e.* f℥xxxj.) of the rectified spirit, or exactly four times its volume. Spirit of nitric ether ought not to be kept long, as it always undergoes decomposition, and becomes at length strongly acid. Its density, by this process, is 0·847.

The directions of the *Dublin College* are as follows:—Take of Rectified Spirit, two pints and eight fluidounces; Pure Nitric Acid, three fluidounces; Water, one ounce; Solution of Ammonia, a sufficient quantity: Place six ounces of the spirit in a glass matrass capable of holding a quart, and connect this with a Liebig's condenser, whose further extremity is fitted loosely by a collar of tow into a thin eight-ounce phial. Add now the water to the nitric acid, and, having introduced half of the resulting solution into the matrass, through a safety syphon tube, close the mouth of this tube with a cork, and apply for a few moments a gentle heat, so as to cause a commencement of ebullition. When the *action* (which, shortly after commencing, proceeds with much violence, and should be moderated by the external application of cold water) has relaxed, introduce gradually the remainder of the acid, so as to restore it. The action having entirely ceased, agitate the distilled product with half its bulk of the solution of ammonia, allow the mixture to rest for a few minutes, and, having separated the supernatant ethereal liquid, mix four ounces of it with the rest of the spirit, and preserve the product in small, strong, and accurately stopped bottles.

In the performance of the preceding distillation the condenser should be fed with ice-cold water, and the phial, in which the distilled liquid is received, should be surrounded by a mixture of one part salt and two of pounded ice; or, when ice cannot be procured, with a mixture of eight parts of sulphate of soda in small crystals and five of commercial muriatic acid.

[The following directions are given in the *United States Pharmacopœia*:—"Take of Nitrate of Potash, in coarse powder, lb. ij.; Sulphuric Acid, lb. iss.; Alcohol, Oixss.; Diluted Alcohol, Oj.; Carbonate of Potash, ℥j. Mix the nitrate of potash and the alcohol in a large glass retort, and having gradually poured in the acid, digest with a gentle heat for two hours; then raise the heat and distil a gallon. To the distilled liquor add the diluted alcohol and carbonate of potash, and again distil a gallon."—ED.]

At Apothecaries' Hall, London, this preparation is made in an earthenware still, with a condensing worm of the same material. The still is heated by the slow application of steam to its outer surface.[1] The *theory*[2] of the process is essentially the same as that for preparing pure hyponitrous ether. The latter, when formed, distils over along with rectified spirit, and constitutes the Spiritus ætheris nitrici, *Ph. L.*

PROPERTIES. *a.* *OF HYPONITROUS ETHER.*—*Pure hyponitrous*

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[1] Brande, *Manual of Pharmacy*, 3d edit. p. 461, London.

[2] Dr. Golding Bird (*Lond. and Edinb. Phil. Mag.* 1839, vol. xiv. p. 324) says, that while the ether distils, mixed with alcohol only, oxalhydric [saccharic] acid ($C^{12}H^{10}O^{16}$), but no oxalic acid, is formed. He also states, that aldehyd is generated, but does not appear in the distilled liquid until the formation of ether has nearly or entirely ceased; the aldehyd and oxalic acid being nearly of simultaneous origin.

ether, prepared by Liebig's process, is pale yellow, has a most fragrant smell of apples and Hungary wines, boils at 62°, and has the sp. gr. of 0·947 at 60°. It may be mixed with an alcoholic solution of potash without becoming brown (showing the absence of aldehyd); hyponitrite of potash and alcohol are formed. *Impure hyponitrous ether*, prepared by the ordinary processes, boils at 70° F., and has the sp. gr. 0·886 at 40°. Its smell is like that of the former, but at the same time suffocating. Mixed with an alcoholic solution of potash it becomes dark brown (showing the presence of aldehyd), with the production of resin of aldehyd. It is highly inflammable, burning with a bright flame. When kept it becomes acid, while nitric oxide gas is given off. This tendency to become acid is greater when air is admitted, and depends on the presence of aldehyd, which is oxidised by the oxygen of the air or of the hyponitrous acid. It is soluble in 48 parts of water, and miscible, in all proportions, with ether and alcohol (Liebig). The following is the composition of the pure hyponitrous ether:—

	At.	*Eq. Wt.*	*Theory.*	*Dumas & Boullay.*
Carbon	4	24	32·00	32·69
Hydrogen	5	5	6·67	6·85
Oxygen	4	32	42·67	41·46
Nitrogen	1	14	18·66	19·00
Hyponitrous Ether	1	75	100·00	100·00

Or,	*Atoms.*	*Eq. Wt.*	*Per Cent.*
Hyponitrous Acid	1	38	50·66
Oxide of Ethyle (Ether)	1	37	49·34
Hyponitrite of Oxide of Ethyle (AeO, NO_3)	1	75	100·00

β. *OF SPIRITUS ÆTHERIS NITRICI.*—Spirit of nitric ether is a colourless, limpid liquor, having a fragrant ethereal odour, somewhat analogous to that of ripe apples, and a pungent, aromatic, sweetish acidulous taste. Prepared according to the London Pharmacopœia, its sp. gr. should not exceed 0·834; but the preparation of the Edinburgh Pharmacopœia has a sp. gr. of 0·847. It is very volatile, producing much cold by its evaporation. It is very inflammable, and burns with a whitish flame. By keeping, it usually becomes strongly acid; though I have had some kept for several years which possessed only slight acidity. It dissolves in alcohol and water in all proportions. "Hyponitrous ether may be separated from the alcohol, water, and uncombined acid, which the preparation of the Pharmacopœia contains, by digesting lime reduced to powder in it, and subjecting the mixture to distillation."[1]

CHARACTERISTICS.—It is principally distinguished by its peculiar odour, its inflammability, its lightness, and its miscibility with water. The spirit of nitric ether of the shops usually strikes a deep olive colour with the protosulphate of iron, thereby indicating the presence of binoxide or an acid of nitrogen; and produces, with tincture of guaiacum, a blue tint, which passes through various shades of green: this last effect depends on the presence of an acid of iron. These effects are not invariably produced; for in some spirit of nitric ether which I had had for several years they did not take place.

COMPOSITION.—Spirit of nitric ether is a mixture of [impure] *hypo-*

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[1] Mr. R. Phillips, *Translation of the Pharmacopœia*, 4th edit. Lond. 1841.

nitrous ether and *rectified spirit.* Prepared according to the Edinburgh Pharmacopœia, its composition is as follows:—

	Vols.	*Sp. Gr.*	*Weight.*
Hyponitrous ether	1	0·886	20·9
Rectified spirit	4	0·838	79·1
Spiritus Ætheris Nitrici, *Ph. Ed.*	5	0·847	100·0

PURITY.—Few articles of the Pharmacopœia are more extensively adulterated than spirit of nitric ether. To prove how great a fraud must be practised with it, I may mention that, in July 1840, Mr. Hennell informed me, that it was then selling in the trade at a price which was but just above that of the duty on the spirit used in manufacturing the genuine article. Wholesale dealers usually keep two, or even three, qualities of this preparation: the inferior ones being obtained by diluting the best with different quantities of water, or spirit of wine and water. Some years since large quantities of spirit of wine, flavoured with hyponitrous ether, were imported from Ireland into London, under the name of spirit of nitric ether, in order to evade the duty payable on it as spirit of wine. Aldehyd and an acid of nitrogen are accidental impurities frequently present. The goodness of spirit of nitric ether is to be estimated in part by an attentive examination of the flavour, and by taking the specific gravity of this liquid. Prepared according to the process of the London Pharmacopœia, its density is 0·834. A free acid (an acid of nitrogen) may be recognised by litmus, and by the effervescence produced on the addition of the alkaline carbonates. The *Edinburgh College* gives the following characteristics of the purity of spirit of nitric ether:—

"Density, 0·847; it effervesces feebly, or not at all, with a solution of bicarbonate of potash. When agitated with twice its volume of muriate of lime, 12 per cent. of ether slowly separates."

Two samples of spirit of nitric ether, prepared by Messrs. Howard and Co., of Stratford, I found to be 47·8 *over proof,* according to Sikes's hydrometer; indicating the sp. gr. to be about 0·85. But I failed to separate the hyponitrous ether by the use of a solution of chloride of calcium, as directed by the Edinburgh College.

[The differences in specific gravity and in the boiling point show that this compound must vary greatly in its chemical constitution, and therefore in its medicinal properties. Mr. Macfarlan has compared the formulæ of the three Pharmacopœias, reducing the alcohol and NO^5 of each to the anhydrous state. The products have been dealt with in the same way, and the loss of alcohol in each process determined.

	MATERIALS USED.		THE PRODUCT CONTAINS—	
	Dry Alcohol.	*Dry* NO_5.	*Dry Alcohol.*	AeO, NO_5
London	28·143	2·932	17·356	4·140
Edinburgh	32·547	8·368	21·93	6·975
Dublin	33·771	3·586	29·54	3·600

The loss per cent. by weight in dry alcohol is, according to the same authority, London, 29·3; Edinburgh, 19·47; Dublin, 5·96. Mr. Macfarlan considers that the Edinburgh process, as modified by the Dublin College, is the easiest, safest, and most productive, and its results are defined and definite. The Edinburgh preparation undergoes a rapid change, a large amount of nitric acid being set free in it soon after its preparation. The weaker the compound is, the better it is found to keep. This rapid change may explain why the author failed to separate the hyponitrous ether by a solution of chloride of calcium, according to the tests given. These tests are applicable only to the recent preparation.[1]—ED.]

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.*—Its effects on plants have not been ascertained.

β. On Animals.—I am not acquainted with any experiments made to determine its effects on animals generally. Veterinarians employ it as a diuretic on various occasions, and as a stimulant in the advanced stages of fever, to rouse the exhausted powers of horses.[2]

γ. On Man.—The inhalation of its *vapour* is dangerous when too long continued, as is proved by the following case:—A druggist's maid-servant was found one morning dead in her bed, and death had evidently arisen from the air of her apartment having been accidentally loaded with the vapour of this liquid from the breaking of a three-gallon jar of it. She was found lying on her side, with her arms folded across the chest, the countenance and posture composed, and the whole appearance like that of a person in a deep sleep.[3]

Taken as a *liquid* internally, in moderate doses, it operates as a volatile stimulant and diuretic. According to the experiments of Alexander, it acts mildly on the kidneys. It is believed to possess diaphoretic properties. By some pharmacologists it is described as being refrigerant,—a quality which it owes perhaps to the free acid which it usually contains. I am unacquainted with the effects of large doses, but they are probably analogous to, though less energetic than, those of other ethereal compounds. Kraus[4] says, a boy twelve years of age took a drachm in the morning fasting, and that it caused violent colic, which lasted for six hours, and was accompanied with vomiting. Probably these effects arose from the preparation containing a considerable quantity of free acid.

[Dr. Snow considers from his experiments that the vapour of nitric ether would act as a safe anæsthetic in surgery, if its effects were agreeable. The inhalation of it produced vomiting in dogs, and he has himself experienced a feeling of sickness on two or three occasions after respiring it. Dr. Simpson found it to produce sensations of noise and fulness in the head before insensibility; and usually much headache and giddiness afterwards. Dr. Snow gave the vapour to a patient who was about to have a tooth extracted. It was inhaled from a chloroform apparatus. The pulse became accelerated and increased in force, and his face was rather flushed. The patient inhaled steadily for three minutes, when the sensibility of the conjunctiva was considerably diminished, although voluntary motion continued in the eyes and eyelids, and he held his head upright. The expression of the countenance was that of complete consciousness. The tooth was removed without causing any sensation of pain. The man felt well and walked away in a few minutes afterwards. A fluidrachm and a half of nitric ether was employed, and it was not all used.[1] This vapour is inferior to chloroform as an anæsthetic, and has not therefore come into general use.—ED.]

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[1] [For further details see *Pharm. Jour.* vol. xv. p. 403, 1856.—ED.]

[2] Youatt, *The Horse*, in the *Library of Useful Knowledge.*

[3] Christison's *Treatise on Poisons.*

[4] *Heilmittellehre*, S. 484, Göttingen, 1831.

USES.—Spirit of nitric ether is employed as a diuretic in some disorders of children, and in mild dropsical complaints, as in the anasarca which follows scarlatina. It is given in conjunction with squills, acetate or nitrate of potash, or foxglove. As a refrigerant and diaphoretic, it is used in febrile complaints in combination with the acetate of ammonia and emetic tartar. As a carminative it is frequently useful in relieving flatulency and allaying nausea. On account of its volatility it may be applied to produce cold by its evaporation. Spirit dealers employ it as a flavouring ingredient.

ADMINISTRATION.—The usual dose of this liquid in febrile cases is fʒss. to fʒij. or fʒiij. When we wish it to act as a diuretic, it should be given in large doses, as two or three tea-spoonfuls.

ANTIDOTES.—In poisoning by the inhalation of the vapour of this compound, the treatment will be the same as that described for poisoning by carbonic acid gas.

317. ÆTHER HYDROCHLORICUS.—HYDROCHLORIC ETHER.

HISTORY AND SYNONYMES.—In the Edinburgh Pharmacopœia for 1735, was a preparation called *Spiritus Salis dulcis.* It was a solution of hydrochloric ether in rectified spirit. Very little, however, was known of the properties of this ether till Gehlen published a dissertation on the subject, in 1804.[2] This ether has had various appellations, such as *Chlorhydric Ether*, *Muriatic Ether*, *Marine Ether*, and, hypothetically, *Chloride of Ethyle.*

PREPARATION.—It is best obtained by saturating alcohol with hydrochloric acid gas, and distilling, by means of a water-bath, into a carefully cooled receiver. [It may be deprived of water by digestion with chloride of calcium.—ED.]

By the reaction of one equivalent or 37 parts of hydrochloric acid (HCl) on one equivalent or 46 parts of alcohol ($C^4H^5O + HO$), we obtain one equivalent or 65 parts of hydrochloric ether (C^4H^5Cl) and two equivalents or 18 parts of water ($2HO$). [Or $AeO, HO + HCl = AeCl + 2HO$.—ED.]

PROPERTIES.—Hydrochloric ether is a colourless liquid, having a penetrating aromatic odour, and a taste somewhat sweetish. Its sp. gr. is 0·874 at 40° F. It boils at 52° F. This great volatility prevents its being kept in the shops. When pure it is quite neutral, dissolves in about 24 parts of water, does not precipitate nitrate of silver, and burns with a flame edged with green, producing vapours of hydrochloric acid. By the slow action of hydrate of potash on it, chloride of potassium and alcohol are formed.

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[1] [*Medical Gazette*, vol. xli. p. 1075.]

[2] Thomson's *System of Chemistry of Inorganic Bodies*, 7th edit. ii. 310, Lond. 1831.

Its composition is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	4	24	36·92
Hydrogen	5	5	7·69
Chlorine	1	36	55·38
	—	—	——
Hydrochloric Ether	1	65	99·99

Or,	*Atoms.*	*Eq. Wt.*	*Per Cent.*
Ethyle	1	29	44·61
Chlorine	1	36	55·38
	—	—	——
Chloride of Ethyle (AeCl)	1	65	99·99

PHYSIOLOGICAL EFFECTS AND USES.—It is a highly diffusible stimulant, like the other ethers, but is rarely employed alone; though it has been used as an antispasmodic.

SPIRITUS ÆTHERIS HYDROCHLORICI; *Æther Muriaticus Alcoholicus; Spiritus Muriatico-Æthereus; Spiritus Salis dulcis; Spirit of Hydrochloric Ether; Spirit of Muriatic Ether; Dulcified Marine Acid.*—In the Edinburgh Pharmacopœia for 1735, this was ordered to be prepared by adding one part of muriatic acid to three parts of rectified spirit, digesting for some days, and then distilling by the heat of a sand bath. Or it may be prepared by dissolving hydrochloric ether in an equal volume of rectified spirit. Liebig says, that the spiritus muriatico-ethereus, used on the continent, contains *heavy muriatic ether*, the composition of which is not known. The action of spirit of muriatic ether seems to be similar to that of nitric ether. A scruple of it thrown into the veins of a buck augmented the renal secretion.[1] An ounce and a half injected into the jugular vein of a dog coagulated the blood, caused difficulty of breathing, and death.[2] It has been used in dyspeptic affections connected with hepatic obstructions. In hectic fever, Berends[3] found its continued use beneficial. The dose of it is fʒj. to fʒiij.

318. ÆTHER ACETICUS.—ACETIC ETHER.

(Acetas Æthylicus, *Pharm. Norveg.*)

HISTORY.—It was discovered by Count de Lauraguais, in 1759.[4]

PREPARATION.—It is prepared by submitting to distillation a mixture of 16 parts of dry acetate of lead, 4½ of alcohol, and 6 of oil of vitriol; or 10 parts of crystallised acetate of soda, 15 of oil of vitriol, and 6 of alcohol, at 80 or 85 per cent. The product is rectified with slaked lime and chloride of calcium, to remove acid and water; and a quantity of acetic ether, equal in weight to the alcohol, is obtained (Liebig).

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[1] Lanzoni, quoted by Wibmer, *Die Wirkung*, &c. Bd. i. S. 56.

[2] Freind, quoted by Wibmer.

[3] Sundelin, *Handbuch der speciellen Heilmittellehre*, Bd. ii. S. 71, 3tte Aufl. Berlin, 1833.

[4] Thomson, *op. supra cit.*

Properties.—Acetic ether is colourless, and has an agreeable odour of acetic acid and ether. Its sp. gr. is 0·89 at 60°. It boils at 165°. It is soluble in 7 parts of water, and mixes with alcohol and ether in every proportion. Oil of vitriol resolves it into ether and acetic acid. [It is decomposed by alkalies, yielding an acetate and alcohol. It is always present in small quantity in wine-vinegar, which owes its agreeable flavour to it.—Ed.]

Composition.—The composition of this ether is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	8	48	54·54
Hydrogen	8	8	9·1
Oxygen	4	32	36·36
Acetic Ether	1	88	100·00

Or,	*Atoms.*	*Eq. Wt.*	*Per Cent.*
Ethyle	1	29	32·95
Oxygen	1	8	9·1
Acetic acid	1	51	57·95
Acetate of the Oxide of Ethyle	1	88	100·00

$(AeO\,\overline{Ac}$ or $AeO\,AcO_3)$

Physiological Effects and Uses.—Acetic ether is not used in medicine in this country. On the continent, however, it is occasionally employed. It is somewhat similar in its operation to the other ethers; but is milder, more agreeable, and more diaphoretic. It is used in nervous and putrid fevers, in cardialgia, spasmodic vomiting, and asthenic affections of the stomach and alimentary canal.[1] Dose, f℥ss. to f℥ij.

319. ACIDUM ACETICUM, *L. E. D.*—ACETIC ACID.

(*Acetylic Acid.*)

History.—Vinegar must have been known from the most remote periods of antiquity. It is mentioned, by Moses,[2] 1490 years before Christ. Hippocrates[3] employed it (ὄξυς) medicinally. Hannibal, in his passage over the Alps, is said to have softened the rocks by fire and vinegar.[4] Geber[5] was acquainted with the purification of vinegar by distillation. Stahl, in 1723, obtained concentrated acetic acid from the acetates by the action of sulphuric acid.[6]

Natural History.—Acetic acid is peculiar to the organised kingdom. Acetic acid, free, or combined with potash, lime, or ammonia, is met with in the juices of many plants. Thus Vauquelin found the acetates of potash and lime in the sap of the elm; and Morin detected acetate of ammonia in the fruit of Areca Catechu. Many vegetable substances yield it by decomposition. Acetic acid is said to have been detected in the gastric juice, the perspiration, the urine, the milk, and the blood. It is probable, however, that in most, if not all, of these cases, lactic acid was mistaken for acetic acid.

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[1] Sundelin, *op. supra cit.*

[2] *Numbers*, vi. 3.

[3] *De Natura Muliebri.*

[4] Livy, c. 37.—Polybius, however, from whom Livy has borrowed the greater part of his narrative, does not mention the use of vinegar. See some remarks on this subject in *A Dissertation on the Passage of Hannibal over the Alps*, p. 107, Oxford, 1820.

[5] *Investigation of Perfection*, ch. iii.

[6] Dulk, *Die Preussische Pharmak. übers. und erläutert*, 2ter Th. S. 123, 2te Aufl. Leipz. 1830.

Gmelin[1] says, acetic acid has been found in some mineral waters. If the observation be correct, the acid is probably to be referred to some decomposing organic matter accidentally present in the water. Geiger[2] states, that acetate of potash is found in some mineral waters.

PREPARATION.—The acetic acid of commerce is obtained from two sources—vinegar, and pyroligneous acid: the first is procured by exciting the acetous fermentation in certain liquors, the other by the distillation of wood.

1. **Acetous Fermentation.**—All liquids which are susceptible of vinous fermentation may be made to yield vinegar. A solution of saccharine matter (or some substance capable of producing sugar) is the essential ingredient. It is converted, by fermentation, first into alcohol, and subsequently into acetic acid. The liquids employed in the manufacture of vinegar vary according to circumstances. In this country the vinegar of commerce is obtained from an infusion of malt, or of a mixture of malt and raw barley. In wine countries it is procured from inferior wines. Dilute spirit, beer, a solution of sugar, and other liquids, are also susceptible of the acetous fermentation.

1. *Malt Vinegar* (*Acetum*, L.; *Acetum Britannicum*, or *British Vinegar*, E.)—This is prepared from malt, or a mixture of malt and raw barley, which is mashed with hot water, as in the ordinary operation of brewing. The cooled wort is then transferred to the fermenting tun, where it is mixed with yeast, and undergoes the vinous fermentation. The wash is then introduced into barrels standing endways, tied over with a coarse cloth, and placed close together in darkened chambers, artificially heated by a stove.[3] Here the liquor remains until the acetous fermentation is complete. This process usually occupies several weeks, or even months. The product is not yet fit for sale. It is introduced into large tuns furnished with false bottoms, on which is placed *rape* (the residuary fruit which has served for making domestic wines). These rape-tuns are worked by pairs; one of them is quite filled with the vinegar from the barrels, and the other only three-quarters full, so that the fermentation is excited more easily in the latter than the former, and every day a portion of the vinegar is conveyed from one to the other, till the whole is completely finished, and fit for sale.[4] Green twigs, or fresh cuttings of the vine, recommended by Boerhaave, are sometimes employed, instead of rape, to flavour vinegar. Formerly acetification was effected by

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[1] *Handb. d. Chem.* Bd. ii. S. 126.

[2] *Handb. d. Pharm.* Bd. i. S. 601, 3tte Aufl.

[3] The proper temperature is usually stated to be about 80° F.; but I suspect a much higher temperature is employed. I found the heat of one of these chambers so great, that I was unable to support it beyond a few minutes. The proprietor of the establishment (one of the largest vinegar works in the metropolis) refused to allow me to inspect the thermometer hanging up in the chamber.

[4] For further information on this subject, consult Aikins' *Dictionary of Chemistry*, vol. ii. p. 468, Lond. 1807; and Donovan's *Domestic Economy*, vol. i. 1830, in Lardner's *Cabinet Cyclopædia*.

placing the wash in barrels, the bung-holes of which were loosely covered with tiles. These barrels were then exposed to the sun and air for several months, until the acetification was perfect. But the introduction of stoved chambers has nearly superseded this method.

Malt vinegar has a yellowish-red colour, an agreeable acid taste, which it owes to acetic and partly to sulphuric acid, and a peculiar refreshing pleasant odour, which it derives from acetic acid and acetic ether. Vinegar of four different degrees of strength is sold by the makers. They are distinguished as Nos. 18, 20, 22, and 24: the latter, which is the strongest, is also called *proof vinegar*, and is estimated to contain 5 per cent. of real acetic acid; but, according to Mr. Phillips, it does not usually contain more than 4·6 per cent. One fluidounce (=446 grs.) of the latter strength should saturate very nearly 58 grs. of crystallised carbonate of soda. In the London Pharmacopœia it is stated that one fluidounce should saturate 60 grs. of crystallised carbonate of soda: the two grains extra being "allowed for saturating the sulphuric acid permitted to be mixed with vinegar, and for decomposing the sulphates of the water used in vinegar-making."[1] The Edinburgh College fixes the density of British Vinegar at from 1·006 to 1·012; but it is usually higher than this. Mr. Phillips[2] found it, in one sample obtained from a respectable source, to be 1·019. Dr. T. Thomson found it to vary from 1·0135 to 1·0251. Vinegar is very liable to undergo decomposition: it becomes turbid, loses its acidity, acquires an unpleasant odour, and deposits a slippery gelatiniform substance. The mucilaginous coat or skin which forms on the surface of vinegar, and is called the *mother of vinegar*, appears to consist of myriads of exceedingly minute vegetables, having a globular form.[1] The surface of vinegar is frequently covered by mouldiness (*Mucor Mucedo*). The microscopic animals, called Vinegar Eels[4] (*Anguillula Aceti*), are generated and nourished in vinegar. They may be destroyed by submitting the liquid in which they are contained to heat. Vinegar is also infested by a small fly (*Musca cellaris*).

[The *Vinegar Plant*, as it is called, is a leathery-looking fungus which covers the whole surface of a saccharine solution during the process of conversion of the sugar of saccharine liquid to acetic acid. A portion of this fungus placed in any saccharine liquid at a moderately high temperature, rapidly converts the sugar to acetic acid. It appears to act by its pores being thoroughly impregnated with acetic acid, and the acetic acid which it contains thus becomes a ferment for the further conversion of the sugar. A mysterious influence has been ascribed to this plant, and it has been supposed that it produces a purer vinegar than ordinary fermentation. There is, however, no reason to believe that the fungus possesses any special action. Its proper nidus appears to be a liquid containing acetic acid, and by its growth and diffusion it aids the conversion of the sugar to vinegar, the first step in the process being the fermentative action of the acetic acid with which the fungus is impregnated. We have examined vinegar made by this process from a mixture of treacle and water. The only difference we have noticed is an almost entire absence of sulphates, and the presence of a larger quantity of saccharine matter not converted to acetic acid.—ED.]

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[1] Mr. R. Phillips, *Translation of the Pharmacopœia*, 4th edit. p. 51, Lond. 1841.

[2] *Lond. Med. Gaz.* new series, vol. ii. for 1838–39, p. 687.

[3] See Keïtzing, in the *Répertoire de Chimie*, iii. 263, Paris, 1838.

[4] See some remarks on these animalcules by Professor Owen, in the *Cyclopædia of Anatomy and Physiology*, ii. 113, Lond. 1839.

Malt vinegar consists of *water*, *acetic acid*, *acetic ether*, *colouring matter*, *a peculiar organic matter*, commonly denominated mucilage, a small portion of *alcohol*, and *sulphuric acid*. Vinegar-makers are allowed to add one-thousandth part by weight of sulphuric acid. This may be detected by a solution of chloride of barium, which forms a white precipitate (*sulphate of baryta*), insoluble in nitric acid.[1] The quantity of sulphate of baryta thrown down from a fluidounce of vinegar, by the addition of solution of chloride of barium, should not exceed 1·14 grains.[2] If the vinegar be free from copper, silver, lead, tin, and other metallic matter, it yields no precipitate on the addition of hydrosulphuric acid (sulphuretted hydrogen). The presence of hydrochloric acid may be recognised by nitrate of silver, which produces a white precipitate (*chloride of silver*) with it, insoluble in nitric acid. The presence of nitric acid in vinegar may be recognised by boiling this liquid with diluted sulphate of indigo. The colour is discharged. Or it may be detected by saturating the suspected acid with potash or soda, and evaporating to dryness: the residue deflagrates, when thrown on red-hot coals, if nitric acid be present. The following is the note appended to the *Acetum* (P. L.), which is now removed to the Materia Medica by the London College:— Reddish-brown, with a peculiar odour; specific gravity 1·019. An ounce is saturated by a drachm of crystals of carbonate of soda. No further precipitation can be effected by the addition of chloride of barium to the vinegar, after ten minims of the solution of the chloride have been added, and the liquor filtered. Its colour is not changed by hydrosulphuric acid.

[Good vinegar does not require the addition of sulphuric acid. The vinegar manufactured by Messrs. Hall and Co. we have found to be quite free from this acid, and in other respects very pure. In testing vinegar for sulphuric acid by a salt of baryta, it is proper to remember that the sulphates naturally contained in the water used may lead to an error. A precipitate may be occasioned by the presence of small quantities of sulphate of lime or sulphate of soda, and not be due to the presence of free sulphuric acid. See note [1] below.—ED.]

2. *Wine Vinegar* (*Acetum Gallicum*, or *French Vinegar*, E. D.).—In wine countries, vinegar is obtained from inferior wines. In France, wine vinegar is prepared in casks, which are placed in a stoved chamber, heated to between 68° and 77° F. Each vat communicates with the air

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[1] [The presence of alkaline sulphates derived from water or grain may cause a precipitate with this test, and give rise to a fallacy. This can be avoided by testing the incinerated residue of a portion of the vinegar for sulphates.—ED.]

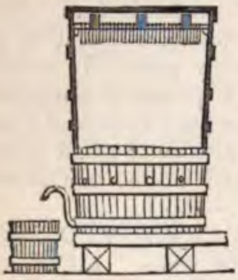
[2] The Edinburgh College states, that "in four fluidounces [of British vinegar] complete precipitation takes place with thirty minims of solution of nitrate of baryta;" but Mr. Phillips (*Lond. Med. Gaz.* Aug. 3, 1839) has shown, that more than three times this quantity of nitrate is required.

by two apertures. Every eight or ten days the liquor in the vats must be changed. Either red or white wine may be used, but the latter is generally employed.[1]

Wine vinegar is of two kinds, *white* and *red*, according as it is prepared from white or red wine. *White wine vinegar* is usually preferred, as it keeps better. That which is made at Orleans is regarded as the best. According to the Edinburgh Pharmacopœia, its density varies from 1·014 to 1·022. A sample of it, examined by Mr. Phillips, had a density of 1·016; and 100 minims of it saturated nearly 14 grains of crystallised carbonate of soda, while an equal quantity of English vinegar, exclusive of the sulphuric acid which it contains, saturated little more than 12 grains; consequently, the French is stronger than the English vinegar by nearly one-sixth.[2] The constituents of wine vinegar are very similar to those of malt vinegar. It contains a small quantity of bitartrate and sulphate of potash. Both these salts occasion precipitates with barytic solutions: but that produced by the bitartrate is soluble in nitric acid. The Edinburgh College states that "ammonia, in slight excess, causes a purplish muddiness, and slowly a purplish precipitate. In four fluidounces, complete precipitation takes place with 30 minims of solution of nitrate of baryta," *Ph. Ed.* But Mr. Phillips[3] has shown that this quantity of nitrate is more than twice as much as is requisite.

3. *Improved, German, or Quick Method of Vinegar-making.* — As acetification is essentially the oxidation of alcohol, the German chemists have contrived an improved method of effecting it, by which the time necessary to the production of vinegar is greatly curtailed. It consists in greatly enlarging the surface of the liquid exposed to the air.

FIG. 86.



Vinegar Generator.

(The upper part of the figure represents a vertical section of the tub.)

This is effected by causing a mixture of one part of alcohol at 80 per cent., four to six parts water, $\frac{1}{1000}$ of ferment, honey, or extract of malt, to trickle down through a mass of beech shavings steeped in vinegar, and contained in a vessel called a *Vinegar Generator* (*Essigbilder*) or *Graduation Vessel.* It is an oaken tub, narrower at the bottom than at the top, furnished with a loose lid or cover, below which is a perforated shelf (colender or false bottom), having a number of small holes, loosely filled with packthread about six inches long, and prevented from falling through by a knot at the upper end. The shelf is also perforated with four open glass tubes, as air vents, which have their ends projecting above and below the shelf. The tub, at its lower part, is pierced with a horizontal row of eight equidistant round holes, to admit atmospheric air. One inch above the bottom is a syphon-formed discharge-pipe, whose upper curvature stands one inch below the level of the air-holes in the side of the tub. The body of the tub being filled with beech chips, the alcoholic liquor (first heated to between 75° F. and 83° F.) is placed on the shelf. It trickles slowly through the holes by means of the packthreads, diffuses itself over the chips, slowly collects at the bottom of the tub, and then runs off by the syphon pipe. The air enters by the circumferential holes, circulates freely through the tub, and escapes by the glass tubes. As the oxygen is absorbed, the temperature of the liquid rises to 100° or 104° F., and remains stationary at that point while the action goes on favourably. The liquid requires to be passed three or four times through the cask before acetification is complete, which is in general effected in from twenty-four to thirty-six hours.[1] [In this process it will be perceived vinegar is produced from alcohol by simple oxidation. Pure alcohol exposed to air does not undergo this change; but if mixed with platina black in a vessel containing air, oxygen is condensed, and the vapour of alcohol is acetified."—ED.]

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[1] See Guibourt, *Histoire Abrégée des Drogues Simples*, 3ème édit. ii. 630, Paris, 1836; Ure's *Dictionary of Arts*, p. 3, Lond. 1839; and Donovan, *op. supra cit.* p. 328.

[2] *Lond. Med. Gaz.* Aug. 3, 1839.

[3] *Op. supra cit.*

Theory of Acetification.—A remarkable distinction between the acetous and vinous fermentation is, that, for the former to be perfectly established, the presence of atmospheric air (or of oxygen) is essential, while for the latter this is not necessary. During the acetous fermentation the alcohol is converted into acetic acid, by the absorption of atmospheric oxygen. One equivalent or 46 parts of alcohol, with four equivalents or 32 parts of atmospheric oxygen, contain the elements of one equivalent or 51 parts of anhydrous acetic acid, and of three equivalents or 27 parts of water; or one equivalent or 60 parts of hydrous acetic acid, and two equivalents or 18 parts of water, as represented in the following equation, $C^4H^6O^2 + O^4 = 3HO + C^4H^3O^3$ or $2HO + C^4H^3O^3 + HO$. According to Liebig, however, the transformation of alcohol into acetic acid is not immediate and direct. The atmospheric oxygen first oxidizes part of its hydrogen, forming water and aldehyd ($C^4H^4O^2$); and the latter, absorbing oxygen, is converted into acetic acid.

[Liebig's view may be thus more distinctly expressed. In the first stage two equivalents of water are produced and the alcohol is converted into aldehyde. Thus,—

$$\underbrace{C_4H_5O, HO}_{\text{Alcohol.}} + O_2 = \underbrace{C_4H_3O, HO}_{\text{Aldehyde.}} + 2\text{ aq.}$$

In the second stage two additional equivalents of oxygen enter into combination, and acetic or acetylic acid results:—

$$\underbrace{C_4H_3O, HO}_{\text{Aldehyde.}} + O_2 - \underbrace{\overbrace{C_4H_3}^{\text{Acetyle.}}, O_3, HO}_{\text{Hyd. Acetic Acid.}} \text{—ED.]}$$

The reader will observe that the theory of acetification above given does not account for the evolution of carbonic acid during the process. This is generally considered to be an accidental result of continued vinous fermentation, and not essential to the formation of acetic acid.

2. By the Destructive Distillation of Wood.—By the destructive distillation of the hard woods (oak, beech, hornbeam, ash, and birch), in iron cylinders, an impure acid, called Pyroligneous Acid, is obtained. The woods should be dried during several months. The lighter woods, as fir, and old ship timber, do not pay to distil, as the acid product is too weak. Sometimes the still is a cast-iron cylinder, placed horizontally in a furnace, the fire of which plays around the cylinder, as in fig. 87. Another form of still is used at a large manufactory in the neighbourhood of London. It is a short cylinder of large diameter, placed upright in the furnace. The wood, cut up into convenient lengths, is introduced into wrought-iron canisters, in each of which is a hole, to allow of the escape of volatile matters. By the aid of a crane, these canisters are raised and deposited in the cylindrical still, the top of which is then carefully closed and made air-tight by luting. The still communicates with a large iron pipe which passes successively through two tanks of cold water, in which it is variously convoluted, and terminates in an underground reservoir, where tar and an acid liquor are deposited. The incondensable products are carbonic acid and some inflammable gases (carbonic oxide, light carburetted hydrogen, and olefiant gas), which escape. When no more volatile matter comes over, the still is opened, and the canisters being removed while still hot, the apertures in them are carefully closed by damp sand, to exclude air.

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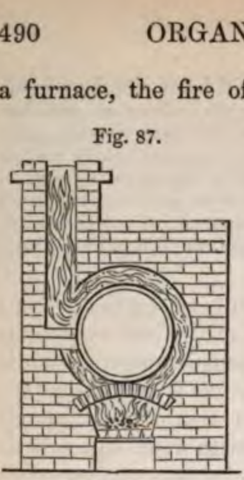
[1] For further details, consult Ure's *Dictionary of Arts*, pp. 4 and 617; Mitscherlich, *Lehrbuch der Chemie*, Bd. i. S. 549, 2te Aufl. Berlin, 1834; and Liebig, in Turner's *Elements of Chemistry*, 7th edit. p. 876.

Fig. 87.



Section of a Pyroligneous Acid Still.

The *tar* obtained by the above process yields, on distillation, *oil of tar*, and a residuum called *English asphalt*, or *pitch*. The *acid liquor*, which rests on the tar in the reservoir, consists of *acetic acid*, *water*, *tar*, and *pyroxylic spirit*. A light tarry matter usually floats on the top of it. By means of a pump, the acid liquor is raised and introduced into a copper still, where it is subjected to distillation. The first runnings contain the pyroxylic spirit. After this has come over, an impure dilute acetic acid, called pyroligneous acid, distils over. The residue in the retort is English asphalt or pitch.

The pyroligneous acid thus obtained is mixed with cream of lime, and the mixture evaporated to dryness in shallow wrought-iron pans, when it forms a black or greyish coloured granular mass, called *pyrolignite of lime*. If this be submitted to distillation with sulphuric acid, it yields an impure acetic acid, which is used in the manufacture of acetate of lead, and for making carbonate of lead by the Dutch process. If pyrolignite of lime be mixed with a solution of sulphate of soda, double decomposition is effected, and sulphate of lime and acetate of soda are the products. The latter is repeatedly crystallised until it is colourless, and is then in a fit state for the manufacture of pure concentrated acetic acid. [In some manufactories the acid liquor, after the separation of the greater part of the tar, by subsidence, is at once neutralised by carbonate of soda, and the crude acetate of soda is obtained by crystallisation, and subsequently purified.—ED.]

PREPARATION OF ACETIC ACID.—The Edinburgh and Dublin Colleges give directions for the preparation of a concentrated solution of acetic acid, which they simply term acetic acid. The London College has removed the Acidum Aceticum to the Materia Medica, and gives the following note for testing the purity of the commercial article which is described as "Acidum e ligno igne præparatum, purificatum."

Free of colour, with a very acrid odour; specific gravity, 1·048; volatilised by heat. No precipitate thrown down in it on the addition of nitrate of silver or chloride of barium. A piece of silver being digested with it, nothing is thrown down on the subsequent addition of hydrochloric acid. Neither is its colour changed on the addition of hydrosulphuric acid, nor ammonia, nor by ferrocyanide of potassium subsequently to the ammonia: 100 grains are saturated by 87 grains of crystals of carbonate of soda. Acidum Aceticum Dilutum, P.L.—Take of Acetic Acid, fʒxxiij.; of Distilled Water, Oj. Add to the acid as much of the water as may fill a pint measure exactly, and mix. The specific gravity is 1·008. A fluidounce of it is saturated by 57 grains of crystals of carbonate of soda.

The *Edinburgh College* gives the following directions:—"Take of Acetate of Lead, any convenient quantity; heat it gradually in a porcelain basin, by means of a bath of oil, or fusible metal (8 tin, 4 lead, 3 bismuth) to 323° F.; and stir till the fused mass concretes again: pulverise this when cold, and heat the powder again to 320°, with frequent stirring, till the particles cease to accrete. Add six ounces of the powder to nine fluidrachms and a half of pure sulphuric acid, contained in a glass matrass: attach a proper tube and refrigeratory, and distil from a fusible metal-bath, with a heat of 320°, to complete dryness. Agitate the distilled liquid with a grain or two of red oxide of lead to remove a little sulphurous acid; allow the vessel to rest a few minutes, pour off the clear liquor, and redistil. The density should be not above 1·065."[1]

The directions of the *Dublin College* are as follows:—

"ACIDUM ACETICUM GLACIALE.—Take of Acetate of Lead, any convenient quantity. Place it in an oven at about the temperature of 300°, until it ceases to lose weight, and, having then brought it by trituration to a fine powder, let it be introduced into a flask or retort, and exposed to an atmosphere of dry muriatic acid gas, until very nearly the whole of it exhibits a damped appearance. The flask or retort being now connected in the usual manner with a Liebig's condenser, let heat be applied by means of a chloride of zinc bath, until the entire of the acetic acid shall have distilled over. The muriatic acid gas should be *slowly* disengaged from the materials directed in the formula for *Acidum Muriaticum*, using eight ounces of salt for every pound of anhydrous acetate of lead; and, to render it quite dry, it should, before being conducted into the vessel containing the sugar of lead, be made to bubble through oil of vitriol, and then pass through a long tube packed with small fragments of fused chloride of calcium. The specific gravity of this acid is 1·065."

ACIDUM ACETICUM FORTE (*Acidum Aceticum*).—Take of Glacial Acetic Acid, f℥vj.; Distilled Water, ℥iv. Mix. The specific gravity of this acid is 1·066.

ACIDUM ACETICUM DILUTUM.—Take of Acetic Acid of commerce (sp. gr. 1·044) Oj.; Distilled Water, Ovij. Mix. The specific gravity of this acid is 1·006.

The *London College* formerly ordered for the preparation of this acid, Acetate of Soda, lb. ij.; Sulphuric Acid, ʒix.; Distilled Water, ℥ix. Add the sulphuric acid, first mixed with the water, to the acetate of soda put into a glass retort, then let the acid distil in a sand-bath. Care is to be taken that the heat, towards the end, be not too much increased. The proportions of acetate of soda, sulphuric acid, and water, above given, are nearly equal to one equivalent or 137 parts of crystallised acetate of soda, one equivalent or 49 parts of the strongest oil of vitriol (protohydrate of sulphuric acid), and six equivalents or 54 parts of water. The results of the distillation, on this calculation, will be the formation of one equivalent or 72 parts of anhydrous sulphate of soda, and the disengagement of one equivalent or 51 parts of anhydrous acetic acid, and thirteen equivalents or 117 parts of water. The calculated results agree very closely with the actual products. The resulting acid consists of 51 real acetic acid and 114·58 water; so that 117—114·58=2·42 of water must remain in the retort with the sulphate of soda. Omitting the water, and treating the acetate of soda as anhydrous, the following equation will represent the chemical changes which ensue, $NaO,C^4H^3O^3+SO^3,HO = NaO,SO^3+\bar{A}c(C^4H^3O^3)HO$.

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[1] For further details, see Thomson's *Chemistry of Organic Bodies*, p. 751, Lond. 1838.

The Edinburgh College employs acetate of lead instead of acetate of soda. The salt is first dried to expel the water of crystallisation, and the anhydrous salt thus obtained is subjected to distillation along with pure oil of vitriol, with the view, I presume, of obtaining glacial acetic acid. Hydrated acetic acid distils over, and sulphate of lead is left in the retort. To remove any sulphurous acid which may be formed, red oxide of lead is ordered to be added to the acetic acid, by which sulphate and sulphite of lead are formed, and the acetic acid is then to be redistilled.[1] The *Dublin College* also employs acetate of lead to yield glacial acetic acid. The reactions are similar to those of the Edinburgh process.

The distillation of acetic acid is usually effected in glass or earthenware stills. On the large scale, silver condensers are sometimes used.

PROPERTIES.—*Glacial Acetic Acid* is the strongest acetic acid procurable. It crystallises at 45° F. when we throw into it any particle of solid matter (a crystal of acetic acid answers best), and the thermometer plunged into it rises at the same time from 45° to 51°. These crystals are brilliant, broad flat plates, of a pearly lustre. They melt at a temperature somewhat below 60° F. The sp. gr. of the liquid at 60° is 1·06296.

When crystals of glacial acetic acid are dissolved in water we obtain a solution which, by way of distinction, we may denominate *liquid acetic acid.* The following table, drawn up by Dr. Thomson,[2] shows the specific gravity of various atomic compounds of this acid and water: —

Acid.		*Water.*	*Sp. gr. at 60°.*
1 atom	+	1 atom	1·06296
1	+	2	1·07060
1	+	3	1·07084
1	+	4	1·07132
1	+	5	1·06820
1	+	6	1·06708
1	+	7	1·06349
1	+	8	1·05974
1	+	9	1·05794
1	+	10	1·05439

More recently Mohr[3] has published the following table, exhibiting the sp. gr. of acetic acid of different strengths: —

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[1] The process of the Edinburgh Pharmacopœia has been critically examined by Mr. R. Phillips (*Lond. Med. Gaz.* new series, vol. ii. for 1839–40, p. 271). It cannot be denied that several unnecessary refinements have been introduced into it, which render the operation troublesome, wasteful, and expensive. Such are the use of a bath of oil or fusible metal,—the addition of red lead,—and subsequent redistillation of the acid to get rid of a quantity of sulphurous acid, which, judging from the quantity of red oxide to be used, cannot exceed the $\frac{1}{2000}$ part of the product. Moreover, the whole process is objectionable, on the ground that acid of this strength is not required for medicinal or pharmaceutical purposes.

[2] *First Principles of Chemistry*, ii. 135.

[3] *Pharm. Central-Blatt* für 1839, S. 840–1.

Per Cent. of Glacial Acid ($C^4H^3O^3$ + Aq.)	*Sp. Gr.*	*Per Cent. of Glacial Acid* ($C^4H^3O^3$ + Aq.)	*Sp. Gr.*	*Per Cent. of Glacial Acid* ($C^4H^3O^3$ + Aq.)	*Sp. Gr.*
100	1·0635	66	1·069	32	1·0424
99	1·0655	65	1·068	31	1·041
98	1·067	64	1·068	30	1·040
97	1·0680	63	1·068	29	1·039
96	1·069	62	1·067	28	1·038
95	1·070	61	1·067	27	1·036
94	1·0706	60	1·067	26	1·035
93	1·0708	59	1·066	25	1·034
92	1·0716	58	1·066	24	1·033
91	1·0721	57	1·065	23	1·032
90	1·0730	56	1·064	22	1·031
89	1·0730	55	1·064	21	1·029
88	1·0730	54	1·063	20	1·027
87	1·0730	53	1·063	19	1·026
86	1·0730	52	1·062	18	1·025
85	1·0730	51	1·061	17	1·024
84	1 0730	50	1·060	16	1·023
83	1·0730	49	1·059	15	1·022
82	1·0730	48	1·058	14	1·020
81	1·0732	47	1·056	13	1·018
80	1·0735	46	1·055	12	1·017
79	1·0735	45	1·055	11	1·016
78	1·0732	44	1·054	10	1·015
77	1·0732	43	1·053	9	1·013
76	1·073	42	1·052	8	1·012
75	1·072	41	1·0515	7	1·010
74	1·072	40	1·0513	6	1·008
73	1·072	39	1·050	5	1·0067
72	1·071	38	1·049	4	1·0055
71	1·071	37	1·048	3	1·004
70	1·070	36	1·047	2	1·002
69	1·070	35	1·046	1	1·001
68	1·070	34	1·045	0	1·000
67	1·069	33	1·044		

From these tables it is obvious that density is no criterion of the strength of liquid acetic acid.

The *Acidum Aceticum* of the Edinburgh Pharmacopœia is stated in one part of that work to have a sp. gr. of not above 1·065, in another to have a sp. gr. of not above 1·0685: moreover, in the same work, the density of the acid is said to be increased by [the addition of] 20 per cent. of water. There are, however, some obvious mistakes in these statements.[1] The *Acidum Aceticum* of the London Pharmacopœia has a sp. gr. of 1·048. One hundred grains of it are saturated by eighty-seven grains of crystals of carbonate of soda. Hence it contains 30·8 per cent. of real or anhydrous acetic acid. It is a limpid, colourless liquid, having a pungent but agreeable odour, and an acrid taste. It possesses the usual properties of an acid;—such as reddening litmus, causing effervescence with the alkaline or earthy carbonates, and saturating bases. It is volatile, and by heat evolves an inflammable vapour.

CHARACTERISTICS.—*Free acetic acid* is known by its peculiar odour and by its volatility. Its vapour reddens litmus, and fumes with ammonia. It does not occasion any precipitate with lime water, solutions of the barytic salts, or a solution of nitrate of silver. It forms with potash a very deliquescent salt. Concentrated acetic acid does not cause effervescence when marble is dropped into it, unless water be added. The *neutral acetates* are all soluble, save those of molybdenum and tungsten. The acetates of silver and protoxide of mercury are slightly soluble. The acetates are known by the acetic odour which they emit on the addition of sulphuric acid and the application of heat, and by the white lamellar and pearly precipitates which many of them produce with the nitrate of silver and the protonitrate of mercury. They redden solutions of the sesquisalts of iron (forming *sesquiacetate of iron*). All the acetates are decomposed by heat, and give results which vary somewhat according to the nature of the base. Some of the acetates, as those of potash, lead, and copper, evolve, when heated, an inflammable fluid, called *acetone* or *pyro-acetic spirit*, whose composition is C^9,H^3,O^9.

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[1] See Mr. R. Phillips, in the *London Medical Gazette*, new series, vol. ii. for 1838–9, p. 688.

COMPOSITION.—Anhydrous or real acetic acid ($\overline{Ac}$) consists of carbon, hydrogen, and oxygen, in the following proportions:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Prout.*	*Berzelius.*
Carbon	4	24	47·06	47·05	46·83
Hydrogen	3	3	5·88	5·88	6·35
Oxygen	3	24	47·06	47·07	46·82
Anhydrous Acetic Acid	1	51	100·00	100·00	100·00

$$[\underbrace{C_4H_3O_3}_{\text{Anhydrous.}} \text{ or } \underbrace{C_4H_3O_3+HO}_{\text{Hydrated.}}]$$

[On the compound radical system acetic acid is considered to be a hydrated oxide of the hypothetical radical acetyle ($Ac=C_4H_3$), with which three equivalents of oxygen and one equivalent of water are supposed to be combined thus: $C_4H_3,O_3+HO=AcO_3,HO$.[2]—ED.]

The *Acidum Aceticum* of the Pharmacopœias is a compound of Anhydrous or Real Acetic Acid and Water. Prepared according to the London Pharmacopœia, 100 grs. of it contain 30·8 grs. of real acetic acid; or very nearly one equivalent of real acetic acid, and 13 equivalents of water.

	Atoms.	*Eq. Wt.*	*Theory.*	*Experiment.*
Anhydrous acetic acid	1	51	30·35	30·8
Water	13	117	69·65	69·2
Acidum Aceticum, *Ph. L.*	1	168	100·00	100·0

Owing to the errors before alluded to in the statements of the Edinburgh College, it is impossible to estimate, correctly, the strength of the acid intended to be obtained by the process given in the Edinburgh Pharmacopœia. If, however, the acid had a sp. gr. of 1·068, and 100 minims of it required 216 grs. of crystallised carbonate of soda to saturate it, as stated by the College, its per-centage quantity of real acetic acid would be 78·65.

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[1] See page 489.

ACETOMETRY. — The strength of acetic acid is best determined by ascertaining the quantity of alkaline carbonate which is required to saturate a given quantity of acid. Crystallised carbonate of soda, or crystallised bicarbonate of potash, are salts of uniform constitution, and may be employed for this purpose. Every 144 grs. of the crystallised carbonate of soda, or 101 grs. of crystallised bicarbonate of potash, are equal to 51 grs. of real acetic acid, or 60 grs. of glacial acetic acid. Marble or carbonate of lime is objectionable, since concentrated acetic acid will not decompose it without the addition of water. It has been already shown that specific gravity is no criterion of the strength of the hydrated acid; since two acids of very unequal strength may have the same density. Moreover, the foreign matters (*i. e.* mucilage and alcohol) contained in vinegar, alter the density of this fluid, though they do not affect its acetometrical strength. The acetometrical method employed by the Excise is that recommended by Messrs. J. and P. Taylor,[1] and consists in estimating the strength of the acid by the sp. gr. which it acquires when saturated by hydrate of lime. Acid which contains 5 per cent. of real acetic acid is equal in strength to the best malt vinegar, called by the makers No. 24, and is assumed as the standard of vinegar strength, under the denomination of *proof vinegar.*[2] Acid which contains 40 per cent. of real acetic acid is, therefore, in the language of the revenue, 35 *per cent. over proof:* it is the strongest acid on which duty is charged by the Acetometer. Vinegars, which have not been distilled, contain mucilage, and require an allowance for the increase of weight from this cause: hence in the Acetometer sold by Bate, a weight marked M is provided, and is used in trying such vinegars.[3] As the hydrate of lime employed causes the precipitation of part of the mucilaginous matter in the vinegar, it serves to get rid of part of the difficulty above referred to.

IMPURITIES.—The presence of sulphuric, hydrochloric, or nitric acid, —of metallic matter,—and of acrid substances in acetic acid, may be detected by the same methods as have already been pointed out for vinegar. Sulphurous acid is recognised by the odour, the action on iodic acid, and the white precipitate (*sulphate of lead*) produced on the addition of peroxide of lead. The presence of lead in acetic acid is known by the yellow precipitate (*iodide of lead*) occasioned by the addition of iodide of potassium, or by the brown colour imparted by a current of hydro-sulphuric acid gas.[4]

PHYSIOLOGICAL EFFECTS.—Before proceeding to notice the operation of acetic acid on vegetables and animals, it may be useful to point out such of its effects on *dead organic matters* as have reference to its influence on living beings. In the first place, it is a well-known and powerful antiseptic, and is employed, partly on this account, in the ordinary operation of pickling, and in the preservation of animal food, and of anatomical preparations. The impure acetic acid obtained in the distillation of wood acts more efficaciously in this respect than the pure acid, on account of the creasote which it contains. Secondly, the action of acetic acid on albumen, fibrin, and blood-discs, deserves especial notice. Liquid albumen (as serum of blood and white of egg) is not coagulated by the ordinary acetic acid of the shops. Coagulated albumen is readily dissolved by it with the evolution of nitrogen, especially with the assistance of heat. Fibrin, as muscle or the crassamentum of the blood, is also dissolved by it: the solution, by evaporation, yields a gelatiniform mass. Caseine is immediately coagulated by it. It changes the form of the red particles of frog's blood, and dissolves part of the red colouring matter.[1] It is an excellent solvent of gelatine, as well as of gelatinous tissue. Diluted and mixed with mucus, it acts as a digestive fluid.[2]

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[1] *Quarterly Journal of Science*, vi. 255.

[2] 58 Geo. III. c. 65.

[3] See *Description of the Acetometer for determining the Strengths of Acetic Acid, made for the Revenue of the United Kingdom*, by R. B. Bate, 21, Poultry, London.

[4] [We have recently discovered as much as two per cent. of acetate of lead in a sample of acetic acid !—ED.]

α. On Vegetables.—Distilled vinegar is ranked, by Achard, among vegetable poisons.[3]

β. On Animals generally.—Concentrated acetic acid acts as a caustic poison to dogs. It causes blackening of the mucous lining of the stomach, analogous to that produced by sulphuric acid.[4] Four or five ounces of common vinegar proved fatal to dogs in ten or fifteen hours, when vomiting was prevented by tying the œsophagus.[5] Injected into the veins, vinegar does not appear to act energetically. Viborg threw two ounces and a half of wine vinegar into the jugular vein of a horse: the next day the animal was well.[6] Analogous results have been obtained by Courten and Hertwich (quoted by Wibmer) and by Pommer.[7] The impure acetic acid obtained by the distillation of wood has been usually regarded as possessing much more activity than pure acetic acid of the same strength, in consequence of the presence of empyreumatic oil. An extensive series of experiments have been made with it on amphibials, birds, and mammals, by Berres, Kerner, and Schubarth. From these it appears that pyroligneous acid is a caustic poison; and that it destroys some of the lower animals, viz. amphibials, merely by contact with the external skin. Large doses affect the cerebro-spinal system, and cause giddiness, insensibility, paralysis, and convulsions. A very constant effect of it was an affection of the windpipe and lungs. The acid was detected by its odour, in the blood and secretions.[8]

γ. On Man.—In the concentrated state acetic acid is an irritant and corrosive poison. Its chemical influence depends principally on its power of dissolving fibrin, albumen, and gelatine, as before mentioned, by which it is enabled to dissolve many of the animal tissues. Applied to the skin it acts as a rubefacient and vesicant. Only one fatal case of poisoning by its internal use is known. The patient (a girl) appeared to be intoxicated, complained of acute pain, and was violently convulsed.[9]

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[1] Müller's *Physiology*, p. 106.

[2] Müller, *op. cit.* p. 545.

[3] De Candolle. *Phys. Végét.*

[4] Orfila, *Journ. de Chim. Méd.* t. vii. p. 449.

[5] *Ibid.*

[6] Wibmer, *Die Wirkung der Arzneimittel. und Gifte*, Bd. i. S. 11.

[7] Christison, *Treatise on Poisons.*

[8] Wibmer, *op. supra cit.*

[9] Orfila, *Journ. Chim. Méd.* t. ii.

Swallowed in a very dilute form, and in moderate doses, it proves refreshing, allays thirst, diminishes preternatural heat, lowers the pulse, and augments the urine. In its general effects, therefore, it appears to lower the powers of life and to prove antiphlogistic. It agrees in its operation with the diluted mineral acids. Its local operation is astringent. Used moderately it assists the digestive process, and is, therefore, taken as a condiment. It is in repute with young ladies for diminishing obesity. "Every one knows," says Giacomini,[1] "that when habitually taken, it produces leanness, from a sort of languor of the digestive process." The following is a case, quoted by this author, from Portal:—

> "A few years ago, a young lady, in easy circumstances, enjoyed good health; she was very plump, had a good appetite, and a blooming complexion. She began to look upon her plumpness with suspicion; for her mother was very fat, and she was afraid of becoming like her. Accordingly, she consulted a woman, who advised her to drink a small glass of vinegar daily: the young lady followed her advice, and her plumpness diminished. She was delighted with the success of the remedy, and continued it for more than a month. She began to have a cough, but it was dry at its commencement, and was considered as a slight cold, which would go off. Meantime, from dry it became moist; a slow fever came on, and a difficulty of breathing; her body became lean, and wasted away; night-sweats, swelling of the feet and of the legs, succeeded, and a diarrhœa terminated her life. On examination all the lobes of the lungs were found filled with tubercles, and somewhat resembled a bunch of grapes."

It is said that the long-continued use of it, in full doses, will induce chronic diseases of the gastro-intestinal mucous membrane; and Morgagni says, it has even given rise to scirrhus of the pylorus. Vinegar may be taken in considerable quantity at one time without inconvenience. Dr. Christison[2] knew a case in which eight ounces were swallowed without injury.

The vapour of strong acetic acid is very pungent and irritating. The long-continued inhalation of acetic vapours by the workmen employed at vinegar-works, is said by Sunderlin[3] to be injurious to the lungs, and to bring on chronic inflammation of these organs. On inquiry among the workmen of a large vinegar-manufactory, I find the notion of the injurious influence of the vapour generally repudiated. Both at these works, and at a pyroligneous acid manufactory, the workmen appeared in excellent health.

USES.—The uses of acetic acid and vinegar, to the medical practitioner, are of two kinds,—medicinal and pharmaceutical.

1. *MEDICINAL.*—Taken internally, common vinegar, or acetic acid properly diluted, is used for various purposes: the most important of these are, to allay febrile heat by its refrigerant qualities; to diminish inordinate vascular action; to relieve certain affections of the brain supposed to depend on, or be connected with, venous congestion; and to act by its chemical properties of an acid. Thus, in *fevers* whether simple or eruptive, but especially in those varieties commonly denominated putrid and bilious, vinegar (more or less diluted with water) is a most refreshing drink, allaying thirst, and diminishing excessive heat. In *hemorrhages*, as from the nose, lungs, stomach, or uterus, it is par-

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[1] *Lond. Med. Gaz.*, new series, vol. ii. for 1838-9, p. 175.

[2] Christison, *Treatise on Poisons.*

[3] *Handb. d. Heilmittellehre.*

ticularly beneficial by its refrigerant, sedative, and astringent qualities. It diminishes excessive vascular action, and promotes contraction of the bleeding vessels. As a local astringent, it is injected into the nose in epistaxis, and is used as a wash in profuse hemorrhoidal discharges. The benefit obtained by the application of vinegar and water to the abdomen, vulva, and thighs, in uterine hemorrhages, arises principally from the cold produced. In *phthisis pulmonalis*, vinegar, diluted with water, is sometimes serviceable as a palliative, by its refrigerant qualities: it relieves the hectic symptoms, diminishes or puts a stop to the night sweats, checks bronchial hemorrhage, and prevents diarrhœa. In *mania*, it has been recommended as a means of allaying cerebral excitement. In *poisoning by opium*, it is used as a counter-poison; but as acetic acid forms very soluble, and, therefore, powerful compounds with morphia, it ought not to be exhibited until the contents of the stomach have been evacuated. In poisoning by the alkalies and their carbonates, and by lime, vinegar is the safest and most efficacious acidulous substance that can be administered. In diseases attended with *phosphatic deposits* in the urine, it may be advantageously used either as a medicine or condiment. *As an adjunct to the acetate of lead*, acetic acid is recommended, by Dr. A. T. Thomson, to prevent the formation of carbonate of lead, which is more apt to produce lead colic than the acetate. In *scurvy*, acetic acid has been found serviceable. *Clysters containing vinegar* have been employed for the purpose of provoking alvine evacuations in obstinate constipation and strangulated hernia; of expelling the small round worm (*Ascaris vermicularis*); of checking uterine and intestinal hemorrhage; and of relieving inflammation or congestive conditions of the brain.

As a stimulant, disinfectant, and antiseptic, diluted acetic acid is used in gangrenous and other ill-conditioned ulcers. For these purposes crude pyroligneous acid is more efficacious than ordinary vinegar, on account of the creasote and other substances which it contains. In ulceration of the throat, in scarlatina, and in cynanche, gargles containing acetic acid or vinegar are sometimes used with good effect. Acetic collyria are useful, as mild astringents, in chronic ophthalmia, and for removing lime-dust adhering to any part of the globe or lid of the eye. Sponging the face, trunk, or extremities, with cold or tepid vinegar and water, usually proves refreshing and grateful in febrile disorders with a hot skin. It diminishes preternatural heat, promotes the cutaneous functions, and operates as a beneficial stimulant to the nervous system. Fomentations containing vinegar are used in bruises and sprains.

The concentrated acetic acid, known in the shops as Beaufoy's, is a valuable remedy for the cure of the different forms of porrigo, popularly called ring-worm or scalled head. Its application, which may be effected by means of a piece of lint wrapped around a wooden stick, causes acute but temporary pain, redness of the skin, and whitening of the abraded spots. One or two applications are usually sufficient to effect a cure. Strong acetic acid is also employed as a caustic to destroy corns and warts. It has been proposed as a speedy means of exciting rubefaction and vesication, and, for this purpose, blotting-paper or cambric, moistened with the acid, has been applied to the neck in cases of croup.

ADMINISTRATION.—Vinegar is used as a condiment *ad libitum*. Medicinally it is given in doses of from fʒj. or fʒij. to f℥ss. As an enema f℥j. or f℥ij. have been used. A refrigerant drink in fevers is made by adding f℥j. or f℥ij. of vinegar to a quart of water. A vinegar wash is prepared by mixing f℥iij. of vinegar and f℥v. of water.

ANTIDOTES.—In poisoning by strong acetic acid, the treatment is the same as that for poisoning by other acids. (See *Acidum Sulphuricum.*)

1. **ACETUM DESTILLATUM**, E.; *Distilled Vinegar.*—The Edinburgh is the only British college that gives directions for the preparation of this liquid.

They are as follows:—"Take of Vinegar (French, by preference) eight parts: distil over with a gentle heat six parts: dilute the product, if necessary, with distilled water till the density is 1·005."

The first portions which distil over are alcohol, acetic ether, water, and a little acetic acid. Thus prepared, distilled vinegar has a yellowish tint, and contains, besides acetic acid and water, a little alcohol, acetic ether, and an organic substance called mucilage. Hence, when it is saturated with alkalies, the solution becomes brown by heat, and deposits a dark-coloured substance, probably arising from the decomposition of the mucilage. Its density is stated to be 1·005; and one hundred minims of it neutralise eight grains of crystallised carbonate of soda, indicating the per-centage quantity of real acid to be 3·07.[1] In order to prevent the distilled vinegar from acquiring a metallic impregnation, the head of the still and the worm or condensing pipe should be of glass or earthenware. At some vinegar works a silver worm is employed.

ACETUM GALLICUM. *French Vinegar* is thus enumerated in the Materia Medica of the Pharmacopœias of Edinburgh and Dublin.

2. **ACIDUM ACETICUM AROMATICUM**, *E.*—(Rosemary, and Origanum, of each ℥j., dried; Lavender, dried, ℥ss.; Cloves, bruised, ʒss.; Acetic Acid, Oiss. Macerate for seven days, strain and express strongly, and filter the liquor). In the former Edinburgh Pharmacopœia there was contained, under the same name, a somewhat similar but weaker preparation, made with *diluted* acetic acid (*i. e.* distilled vinegar), in imitation of the celebrated *Marseilles Vinegar*, or *Vinegar of the Four Thieves*[2] (*Vinaigre des Quatre-Voleurs; Acetum quatuor Furum*), once supposed to be a prophylactic against the plague and other contagious diseases. It was a very useless preparation. In the present Edinburgh Pharma-

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[1] See Mr. R. Phillips, in *London Medical Gazette*, new series, vol. ii. for 1838-9, p. 688; and vol. ii. for 1839–40, p. 271.

[2] "The repute of this preparation as a prophylactic in contagious fevers, is said to have arisen from the confession of four thieves, who, during the plague of Marseilles, plundered the dead bodies with perfect security, and, upon being arrested, stated, on condition of their lives being spared, that the use of aromatic vinegar had preserved them from the influence of contagion. It is on this account sometimes called 'Le Vinaigre des quatre Voleurs.' It was, however, long used before the plague of Marseilles, for it was the constant custom of Cardinal Wolsey to carry in his hand an orange, deprived of its contents and filled with a sponge which had been soaked in vinegar impregnated with various spices, in order to preserve himself from infection, when passing through the crowds which his splendour of office attracted. The first plague raged in 1649, whereas Wolsey died in 1531." (Paris, *Pharmacologia*, 6th edit. vol. ii. p. 18, Lond. 1825.)

copœia, concentrated acetic acid has been substituted for distilled vinegar, and Origanum for Sage. It is now a pungent perfume, and may be used as a substitute for *Henry's Aromatic Vinegar.* But it appears to me to be a very unnecessary preparation.

The *Acetum aromaticum*, or *Aromatic Vinegar* of the shops, is made in imitation of Henry's Aromatic Vinegar. At Apothecaries' Hall it is prepared by dissolving the Oils of Cloves, Lavender, Rosemary, and Acorus Calamus, in crystallisable Acetic Acid. It is a very volatile and corrosive preparation, and requires to be kept in carefully stoppered bottles. Some manufacturers add camphor. The addition of water to it causes the precipitation of the greater part of the camphor. It is a pungent perfume, the vapour of which is snuffed up the nostrils, to produce a powerful excitant impression, in fainting, languor, headache, and nervous debility. For this purpose it is dropped on sponge, which is preserved in smelling-bottles or *vinaigrettes.* It is also used for the purpose of correcting unpleasant odours, which it does, not by destroying, but by disguising them. *An extemporaneous aromatic vinegar* may be prepared by putting into a stoppered-bottle fʒj. of acetate of potash, three drops of some essential oil (as Lavender or Lemon), and twenty drops of oil of vitriol.

3. ACIDUM ACETICUM CAMPHORATUM, E. D.; (Camphor, ℥ss.; Acetic Acid, f℥viss. Pulverise the camphor with the aid of a little rectified spirit, and dissolve it in the acid, *E.*)—(Camphor, ℥j.; Rectified Spirit, ʒj.; Strong Acetic Acid, ℥x. Reduce the camphor to powder by trituration with the spirit; then add the acid and dissolve, *D.*)—This preparation is an officinal substitute for *Henry's Aromatic Vinegar.* The spirit is used merely to assist in reducing the camphor to powder. Camphorated acetic acid is exceedingly pungent and corrosive. Its vapour is snuffed up the nostrils as a powerful stimulant in syncope. It is never used internally.

4. OXYMEL, L. D.; *Syrupus Aceti*, E.; *Oxymel Simplex* or *Simple Oxymel.* (The *London College* directs of Honey, lb. v.; Acetic Acid, ℥vij.; Distilled Water, ℥viij. Mix the acid added to the water with the honey made hot.—The *Dublin College* orders of Honey, by weight, lb. j.; Acetic Acid of Commerce, sp. gr. 1·044, ℥iij. Mix the acid with the honey previously heated, *D.*—The *Edinburgh College* substitutes sugar for honey:—Take of Vinegar, French in preference, f℥xj.; Pure Sugar, ℥xiv. Boil them together.)—It is employed as a detergent and pectoral. It is frequently added to gargles; but is more commonly used as an expectorant in slight colds and coughs. Diffused through barley-water, it forms an agreeable refrigerant drink in febrile and inflammatory complaints. It is sometimes used as a vehicle for other medicines. Dose from ʒj. to ℥ss. or ℥j.

Pharmaceutical Uses.—Vinegar or acetic acid is employed for extracting the virtues of various medicinal substances, as Squills, Opium, Colchicum, and Cantharides: the solutions are called *Medicated Vinegars* (*Acetica*), or by the French pharmacologists, *Oxéolés* (from ὄξος, vinegar). A small quantity of spirit is usually added to them for the purpose of preventing the decomposition of the vinegar, and, in consequence of this, a small portion of acetic ether is generated. They are usually prepared by maceration. The preparations into the composition of which acetic acid and honey enter, are called *Oxymels* (*Oxymellites*), or the *Acid Mellites*. Acetic acid is employed also in the manufacture of the salts called *Acetates*. It is a powerful solvent of the gum-resins, and is used, on this account, in the preparation of the *Emplastrum Ammoniaci*. Lastly, distilled vinegar is used in the preparation of *Cataplasma Sinapis*, *Ceratum Saponis*, *Linimentum Æruginis*, and *Unguentum Plumbi Compositum*.

320. SPIRITUS PYROXYLICUS.—PYROXYLIC SPIRIT.

This compound is known under various names. It is called *Pyroligneous Ether* [*Wood Spirit*, *Wood Naphtha*]; *Hydrate of Oxide of Methyle*; *Bihydrate of Methylene*, and sometimes, but improperly, *Naphtha*. The first runnings of the acid liquor derived from the destructive distillation of wood, are redistilled once or twice, and the product is sold under the name of *pyroligneous ether* or *wood naphtha*. It is an impure liquor, containing, besides hydrate of the oxide of methyle, acetone and other inflammable liquors. It is employed by chemists as a substitute for spirit of wine for burning in lamps, and by hatters and varnish-makers as a substitute for alcohol for dissolving resinous substances. Drs. Babington and Rees[1] have suggested its use for the preservation of subjects for anatomical purposes. The spirit is to be injected into the aorta, the rectum, and the peritoneum. It was tried at the London Hospital, but the smell arising from the spirit was so intolerable, that, even if there were no other objections to its use, this alone would be fatal to it. Pure pyroxylic spirit is obtained by introducing it into a retort with excess of chloride of calcium, and distilling the mixture by a water-bath, as long as volatile matter passes off. A quantity of water, equal to the spirit employed, is then added, and the distillation continued. The product is now pure pyroxylic spirit, carrying along with it a little water, which is removed by a second distillation with quicklime (Liebig).

PROPERTIES.—Pure pyroxylic spirit is a very mobile, colourless, inflammable liquid, which has a peculiar odour, somewhat resembling that of alcohol and acetic ether. [It is more inflammable than rectified spirit or oil of turpentine.] It boils at from 140° to 150° F. It dissolves many resins, mixes with most essential oils, and forms crystalline compounds with baryta, lime, and chloride of calcium. Its composition is as follows:—

	Atoms.	*Eq. Wt.*	*Or,*	*Atoms.*	*Eq. Wt.*
Carbon	2	12	Oxide of Methyle	1	23
Hydrogen	4	4	Water	1	9
Oxygen	2	16		—	—
	—	—			
Pyroxylic Spirit	1	32	Hydrate of Oxide of Methyle	1	32

[Or, $C^2H^3O + HO$, or MeO, HO.]

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[1] *Guy's Hospital Reports*, Oct. 1839; and *Lond. Med. Gaz.* new series, vol. i. for 1839–40.

The repeated use of small quantities of pyroxylic spirit in the liquid state caused colicky pains, and acted as an anthelmintic.[1]

[1. METHYLE, C_2H_3=Me.—This is the radical of pyroxylic spirit. It was first obtained by Frankland and Kolbe as a product of the action of potassium on cyanide of ethyle. It is a gas of a sp. gr. of 1·0365, which is not liquefied by cooling to zero, and which has resisted a pressure of twenty or thirty atmospheres; in which respect it differs remarkably from the analogous radical ethyle, the basis of ether. It is combustible—burning with a bluish flame, and giving but little light. It has an ethereal smell, is not taken up by water, but, like ethyle, is absorbed by alcohol. It exists in nature, like ethyle, in a combined state. Its oxide, or methylic ether, according to Gregory, is found in the oil of *Gaultheria procumbens*, combined with salicylic acid.

2. METHYLIC ETHER; *Oxide of Methyle*, C_2H_3O=MeO.—This is a compound analogous to the ether of alcohol, and it is a product of some interest, inasmuch as it is most probably a constituent of ether obtained from methylated spirit. Methylic ether is procured by distilling pyroxylic spirit with its volume of sulphuric acid. This compound, although so widely different in properties, is polymeric with alcohol, for $C_4H_6O_2=2\,(C_2H_3O)$. In 100 parts these two compounds would have the same elementary composition. There would be the same proportions of the elements, but as the equivalent of alcohol is twice as great as that of methylic ether, the absolute amount of the constituents would be very different. One is considered to be a hydrate, the other an ahydrous oxide.—ED.]

[**METHYLATED SPIRIT.** The great cost of rectified spirit having been found to be an obstacle to its use in various trades and manufactures, an Act of Parliament has been lately passed to allow of the sale, duty free, of a mixture of Pyroxylic Spirit and Spirit of Wine. This act, the 18 and 19 Vict. cap. 37, has been framed principally on a report addressed to the Board of Inland Revenue by Professors Graham, Hofmann, and Redwood.[2] The object of the Board was, while making every reasonable allowance for the use of the spirit in arts and manufactures, to prevent any substitution of the compound for ardent spirits; and the reporters, after numerous experiments with various liquids in different proportions, came to the conclusion that a mixture consisting of one part, by measure, of pyroxylic spirit to nine parts of spirit of wine, would answer the intended purpose. This is in the proportion of ten per cent. of pyroxylic spirit, of a density of 0·815, mixed with twenty per cent. of alcohol, not exceeding a density of 0·830. This mixture they propose to call *Methylated Spirit*, and it is now known and sold, under certain Excise restrictions, by this name. The density of the methylated spirit prepared in the manner above described was found to be 0·815, and it boiled at 169°. The compound has a slightly yellowish colour and the odour and flavour of pyroxylic spirit.

In this preparation the reporters not only regard methylated spirit as not potable, but it is their opinion that by no artificial process can the odour and flavour of pyroxylic spirit be so taken from the mixture as to render it potable. They further state that no danger is to be apprehended of the methylated spirit being ever so compounded as to render it palatable. To insure uniformity of composition, they recommend that the pyroxylic spirit used for the manufacture should be supplied by the

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[1] Dierbach, *Neuesten Entdeck. in d. Mat. Med.* Bd. i. S. 314, 2te Ausg. 1837.

[2] [For this report we refer our readers to the *Pharmaceutical Journal*, vol. xiv. p. 556 (June, 1854). The regulations regarding the preparation and sale of the mixed spirit will be found in the same journal, vol. xv. p. 138; and some remarks, in reference to these regulations, as they affect chemists and druggists, in the same volume, p. 102.]

Board of Inland Revenue. Commencing with a proportion of ten per cent., they think that ultimately this might be reduced to five per cent., or even to a smaller proportion. In a supplementary communication on the quality of the pyroxylic spirit selected for admixture, the reporters suggest that the use of a very impure wood spirit would be unsuitable for some manufactures.

Licences on an extensive scale have since been granted for the mixture and sale of methylated spirit. In one factory which we visited in a densely populated quarter of the city, we found a stock of about 5000 gallons. Apart from the danger attending the storage of such a large quantity of inflammable material in the event of fire, the escape of the vapour, especially in hot weather, is a great nuisance to a neighbourhood; and many persons who lived in houses adjoining the premises above-mentioned, complained of headache, dizziness, nausea, and loss of appetite; still no serious illness could be distinctly traced to the effects of this vapour. Its physiological action has yet to be determined.

There is no doubt that this has now become an important branch of trade, and that methylated spirit is largely substituted for rectified spirit in numerous manufactures. Mr. Macfarlan, in a late number of the Pharmaceutical Journal,[1] has given a summary of the benefits which the new act has conferred on chemists and druggists, hatters, varnish-makers, brass-founders, and others. Most of the Pharmaceutical products hitherto produced at great expense from alcohol, such as ether and chloroform, have been obtained, and are now, probably, largely manufactured, by similar processes from methylated spirit.—ED.]

3. PYROXANTHINE; *Pyroxylene; Eblanine.*—This substance was obtained by Scanlan from raw pyroxylic spirit. It is a crystalline compound of an intensely yellow colour. Oil of vitriol dissolves it, and assumes a dark purple blue colour,[1] with a tinge of red, ultimately becoming black. Concentrated hydrochloric acid also dissolves it, and acquires an intense purple colour.

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	21	126	75·45
Hydrogen	9	9	5·39
Oxygen	4	32	19·16
Pyroxanthine	1	167	100·00

[This corresponds to Gregory's result, $C_{21}H_9O_4$.—ED.]

[321. SPIRITUS PYROACETICUS.—PYROACETIC SPIRIT.

[This compound is known under the name of *Acetone* or *Mesitic Alcohol*, and has been used in medicine under the improper designation of Naphtha. There are three liquids to which the term *Naphtha* has been applied,—Pyroxylic spirit, or wood naphtha; rectified petroleum, or coal naphtha, found also native as a pure colourless hydrocarbon (mineral naphtha); and acetone, the liquid to be now considered. They differ not only in chemical constitution, but in medicinal properties; and there is reason to believe that serious mistakes have arisen from this indiscriminate use of the word naphtha to designate substances so widely different.

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[1] [This reaction somewhat resembles that produced by sulphuric acid and bichromate of potash or strychnia. The bichromate is not, however, necessary to the production of colour with pyroxanthine.—ED.]

PREPARATION.—The author has already adverted to the production of pyroacetic spirit from the distillation of the dry acetates.[1] When acetic acid is passed through a tube heated to low redness, pyroacetic spirit, with some gaseous compounds of carbon, result. The alkaline acetates also yield it when heated; but, according to Gregory,[2] it is best prepared by distilling a mixture of two parts crystallised acetate of lead and one part of quicklime. Carbonate of lime is formed, and pyroacetic spirit distils over.

$$\underbrace{C_4H_3O_3}_{\text{Anhydrous Acetic Acid.}} \quad = \quad CO_2+\underbrace{C_3H_3O}_{\text{Pyroacetic Spirit.}}$$

It may be purified by rectification until its boiling point becomes constant at 100°. In the impure state, the boiling point is about 132°.

PROPERTIES.—It is a clear colourless neutral liquid of sp. gr. 0·792, having a peculiar smell and a hot pungent taste. It is miscible with water, alcohol, and ether, in all preparations, without change, and can be separated from water by distillation with chloride of calcium. It is inflammable, and burns with a luminous flame. The specific gravity of its vapour is 2·022. Its formula is C^3H^3O.

CHARACTERISTICS.—Pyroacetic spirit is known from coal naphtha by the peculiar odour and the smoky flame of the latter, as well as by the fact that this naphtha is not miscible with water. Pyroxylic spirit, as it is commonly met with, has an acid reaction, and when mixed with water renders it milky, from the separation of tarry water. Dr. Ure[3] states that if nitric acid of 1·45 be added to pyroxylic spirit, it assumes a red colour, but there is no effervescence; if added to pyroacetic spirit, it produces no change of colour, but there will be a slow effervescence,—then a copious evolution of gas, as in a mixture of alcohol and nitric acid, but with an acetic instead of an ethereal odour.

MEDICINAL USES.—Dr. John Hastings first called the attention of the profession to the use of this liquid in the treatment of consumption in its various stages.[4] He employed it and prescribed it rather largely under the name of rectified naphtha. Owing to this most unfortunate appellation, mineral naphtha, coal naphtha, and wood naphtha appear to have been used by medical practitioners with the result that sickness and other disagreeable effects frequently followed. The author states, as the result of his experience in two hundred cases of tubercular consumption, that the recoveries under this treatment amounted to sixty-six per cent.! The pyroacetic spirit was generally given in drops, the dose being about twenty minims three times a day, taken in water or some plain liquid. He has also employed the *vapour* with benefit, but it is contraindicated where there is hæmoptysis, or when it produces nausea and sickness. The favourable results of the action of pyro-acetic spirit which he reports have not been verified by the experience of other medical practitioners.—ED.]

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[1] See *antè*, p. 496.

[2] *Pharmaceutical Journal*, vol. xv. p. 311.

[3] *Ibid.* p. 28.

[[4] *Pulmonary Consumption successfully treated with Naphtha*, &c. by John Hastings, M.D. 1845, 2d edit.]

[322. CHLOROFORMYL, *L.*—CHLOROFORMUM, *D.*—CHLOROFORM, OR TERCHLORIDE OF FORMYLE.[1]

(Trichloretum Formylicum, *Ph. Norv.*)

HISTORY.—This compound was discovered by Soubeiran in 1831, and called by him *Bichloric Ether*. It was obtained by Liebig in 1832, and named by him *Chloride of Carbon;* but its true constitution was only made known by Dumas in 1834. We subjoin a short abstract of the progress of this remarkable discovery from the pen of the author.—ED.]

The term *Chloric ether* was applied by Dr. T. Thomson[2] to the liquid formed by the union of equal volumes of chlorine and olefiant gas, and which is described in different chemical works under the name of *chloride of olefiant gas*, or *Dutch liquid*. The formula of this liquid is $C^4H^4Cl^2$. In 1831, Mr. Guthrie, an American chemist, was led to attempt a cheap and easy process for preparing it, by a statement in Silliman's *Elements of Chemistry*, that the alcoholic solution of chloric ether was a grateful and diffusible stimulant. His process was as follows:[3]—

> "Into a clean copper still put three pounds of chloride of lime and two gallons of well flavoured alcohol, of sp. gr. 0·844, and distil. Watch the process, and when the product ceases to come over highly sweet and aromatic, remove and cork it up closely in glass vessels. The remainder of the spirit should be distilled off for a new operation. These proportions are not essential—if more chloride of lime be used, the ethereal product will be increased; nor is it necessary that the proof of the spirit should be very high, but I have commonly used the above proportions and proof, and have every reason to be satisfied with them. From the above quantity I have usually obtained about one gallon of ethereal spirit."

Both Guthrie and Silliman erroneously believed the liquid thus obtained to be an alcoholic solution of the chloride of olefiant gas, and hence they termed it *Chloric ether*. In 1831, Soubeiran[4] submitted to distillation a mixture of chloride of lime and alcohol, and examined the distilled product. He found it to consist of carbon, hydrogen, and chlorine. The atomic composition which he gave for this liquid was, when reduced to the English mode of calculation, CHCl; or $C^4H^4Cl^4$. He termed the liquid *Bichloric ether*, because it contained, as he supposed, twice as much chlorine as is contained in the chloride of olefiant gas. In 1832, Liebig[1] examined the product obtained by submitting to distillation, in a capacious retort, diluted alcohol and chloride of lime. He analysed the distilled product, but failed to detect hydrogen in it. According to his experiments, the compound consisted of carbon and chlorine; and the formula which he deduced from this analysis was C^4Cl^5, and he called the liquid *Chloride of carbon.*

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[1] [In the compound radical nomenclature it is called a Terchloride of Formyle, but it has not one of the characters of a soluble chloride about it. It gives no precipitate with nitrate of silver. If pure it may be boiled with nitre without dissolving gold or bleaching indigo. It is a hypothetical chloride, without a single property appertaining to this class of salts.—ED.]

[2] *System of Chemistry*, 6th edit. 1820.

[3] Silliman's *American Journal of Science and Art* for Jan. 1832, vol. xxi. p. 64.

[4] *Ann. de Chim. et de Phys.* t. xlviii. p. 131.

In 1834, Dumas[2] examined this liquid. He showed that Soubeiran had not obtained it pure, and that Liebig had made an error with regard to its composition. From his analysis, Dumas deduced the following as its real formula: C^2HCl^3. On account of the relation of its composition to that of formic acid, C^2HO^3, the oxygen being replaced by three equivalents of chlorine, Dumas denominated this liquid *Chloroform.* Liebig has admitted the accuracy of Dumas's analysis by adopting his formula; but he calls the product the *Chloride* or *perchloride of formyle* (*Formylchlorid*). The name given by Dumas is that by which it is most commonly known. Thus, then, the liquid which had been used in medicine under the names of *Chloric ether* and *Terchloride of carbon,* is altogether different from the chloride of olefiant gas, to which the name of chloric ether was originally applied.[3]

[Although chloroform had been for some years used internally under the name of chloride of carbon or chloric ether, its properties as an anæsthetic were unknown until the date at which Dr. Simpson performed his experiments. His paper on the use and effects of chloroform in obstetric practice was read before the Medical Society of Edinburgh on the 1st December, 1847. Since then chloroform has passed into use in every country in which medicine is practised; and, in spite of much opposition, has maintained its ground with a large section of the profession.

PREPARATION.—This compound has been introduced into two of the British Pharmacopœias, both of which contain formulæ for its preparation. It is also found in various foreign Pharmacopœias.

The directions of the *London College* are as follows:—Take of Chlorinated Lime, lb. iv.; Rectified Spirit, Oss.; Water, Ox.; Chloride of Calcium, broken into pieces, ʒj. Put the lime first mixed with the water into a retort, and add the spirit to them, so that the mixture may fill only the third part of the retort. Then heat them in a sand-bath, and as soon as ebullition begins, withdraw the heat as quickly as possible, lest the retort should be broken by the sudden increase of heat. Let the liquid distil into the receiver so long that there may be nothing which subsides, the heat being reapplied if necessary. To the distilled liquid add a quarter of the water, and shake them all well together. Carefully separate the heavier portion which subsides, and add the chloride to it, and frequently shake them for an hour. Lastly, let the liquid distil again from a glass retort into a glass receiver."

The *Dublin College* gives the following formula:—"Take of Chlorinated Lime, lb. x.; Fresh-burned Lime, lb. v.; Water, *Cong.* iv.; Rectified Spirit, ℥xxv.; Peroxide of Manganese, in fine powder, ʒij. Slake the lime with a quart of the water, first raised to the boiling temperature, and, having placed the slaked lime and the chlorinated lime in a sheet iron or copper still, pour on the residue of the water first mixed with the spirit, and raised to the temperature of 100°. Connect now the still with a condenser, and apply heat, which, however, must be withdrawn the moment the distillation commences. The distilled product, the bulk of which need not exceed a quart, will occur in two distinct strata, the lower of which is the crude chloroform. Let this be agitated twice in succession, with an equal volume of distilled water, and then in a separate bottle with half its volume of pure sulphuric acid. Lastly, let it be shaken in a matrass with the peroxide of manganese, and rectified from off this at a very gentle heat. The specific gravity of chloroform is 1496. The lighter liquid which distils over with the chloroform, and the water used in washing the latter, should be preserved with the view of their being introduced, with a new charge, into the still in a subsequent process."

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[1] *Ann. de Chim. et de Phys.* t. xlix. p. 146.

[2] *Ibid.* t. lvi. p. 113, 1834.

[[3] Abstract from a paper by the late Dr. Pereira in the *Pharmaceutical Journal,* 1846, vol. v. No. ix.]

The *Pharmacopœia of the United States* gives the following formula:—"Take of Chlorinated Lime, lb. x.; Water, Oiiss.; Alcohol, Oij. Mix the chlorinated lime first with the water and then with the alcohol, in a distillatory vessel having the capacity of six gallons. Distil with a brisk heat into a refrigerated receiver, and when the temperature approaches 176° withdraw the fire in order that the distillation may proceed by the heat derived solely from the reaction of the materials. When the distillation slackens, hasten it by a fresh application of heat, and continue to distil until the liquid ceases to come over with a sweet taste. Separate the heavier layer of liquid in the receiver from the lighter by decantation, and having washed it first with water and then with a weak solution of carbonate of soda, agitate it thoroughly with powdered chloride of calcium, and distil it off by means of a water-bath—stopping the distillation when $\frac{11}{12}$ of the liquid have come over. The residue, together with the light liquid of the first distillation, may be reserved for use in a second operation."

This compound is entered in the *Pharmacopœia Norvegica* under the name of Trichloretum Formylicum, $Fo\,(C_2H)\,Cl_3$ containing 89·11 per cent. of chlorine. It is directed to be made by taking of Alcohol, sp. gr. 0·934, two parts; of Chloride of Lime, five parts; and of Water, thirty parts. The ingredients are mixed and distilled with the usual precautions, so long as an oily-looking liquid is condensed in the receiver. The impure chloroform is separated by decantation from the supernatant liquid, washed with a weak solution of carbonate of soda, and afterwards shaken with concentrated sulphuric acid added by small quantities, until it becomes bright and colourless. It is then poured off and rectified by distillation at a gentle heat. It is directed to be kept in bottles of blackened glass of the capacity of from two to four drachms. Its specific gravity should be 1·48.

Dr. Simpson prefers the formula of Dumas; namely, Chloride of Lime, in powder, lb. iv.; Water, lb. xij.; Rectified Spirit, f℥xij. Mix in a capacious retort, and distil as long as a dense liquid which sinks in the water with which it comes over is produced. Dumas states that the product is equal to the weight of the alcohol employed.[1]

In some of the above formulæ it is recommended to shake the product with concentrated sulphuric acid, with a view of destroying and removing certain oily matters produced during the distillation. We are assured, however, by Mr. Scanlan, a good pharmaceutical chemist, who has given some attention to this manufacture, that chloroform thus treated with sulphuric acid is peculiarly liable to decomposition.

Chloroform is now manufactured from *Methylated spirit.*[2] Gregory describes the product thus procured as less pure than that derived from alcohol; but it would appear, from the researches of Mr. Macfarlan, that this does not depend on any impurity specially caused by the presence of pyroxylic spirit in the proportion in which it exists in methylated spirit. Whether obtained from this spirit or from alcohol, the chloroform is liable to be rendered impure by certain oils produced in the process, and which rise with it in the first distillation. In order to separate these oils, the chloroform should be first agitated with water,

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[[1] *Traité de Chimie*, vol. v. p. 596. For the manufacture and rectification of Chloroform on a large scale, see paper by M. Besnou, *Journal de Chimie Médicale*, 1854, p. 734.]

[2] *Antè*, p. 503.

and then with sulphuric acid, which removes the water, and destroys the oils. It may then be rectified by distillation. The presence of the oils which interfere with the anæsthetic use of chloroform may be therefore readily detected by sulphuric acid, which should not be tinged or coloured by the rectified product. A few drops may be poured on bibulous paper, and its odour watched until it has entirely evaporated. The oils may be detected by the peculiar odour evolved in the last part of the evaporation. Mr. Macfarlan states, in reference to chemical properties, as well as to specific gravity, that no difference can be perceived in the chloroform, whether obtained from alcohol or from methylated spirit; and we are assured, on the same authority, that the vapour of methyle-chloroform has been used in the practice of the Edinburgh hospitals with precisely the same beneficial results as that obtained from alcohol.[1]

The chloroform obtained from *Pyroxylic spirit* is much less pure than that obtained from alcohol. It is specifically lighter than the alcohol-chloroform, has a repulsive empyreumatic odour, and produces unpleasant sensations when inhaled.[2] When mixed with oil of vitriol it is always blackened. According to Sœmerling, the largest quantity of chloroform in proportion to the alcohol used is obtained from a mixture of eight parts of chloride of lime, one part of quicklime, one part of alcohol, and forty parts of water. The rectified chloroform amounts to one-third of the alcohol consumed. The quantity yielded by pyroxylic spirit is less than one-eighth of the quantity of spirit employed.

PROPERTIES.—Chloroform is a transparent colourless ethereal-looking liquid. It has a fragrant apple-like odour, and an ethereal slightly pungent, but sweet taste. It refracts light strongly. Its specific gravity is variously stated at from 1·484 (1·496 Ph. D.) to 1·5, on the authority of Gregory. Its boiling point is 140°, and the density of its vapour is 4·2. It is exceedingly volatile, and produces, by rapid evaporation, great cold when placed on the skin, with a slightly tingling sensation. Its vapour has a sweet taste, producing, when respired, excitement, insensibility, coma, and death, according to the degree of dilution in which it is inhaled. The liquid is not inflammable, but its vapour readily burns with other inflammable vapours. It is not very soluble in water, requiring 2000 parts to dissolve one of chloroform; but it imparts to this liquid its odour and flavour. It is very soluble in alcohol and ether, and alcohol increases its solubility in water. It is readily dissolved by oil of turpentine and bisulphide of carbon. When pure, it is quite neutral. It may be distilled with potash, sulphuric acid, and other acids, without change. Heated with strong nitric or sulphuric acid, it undergoes no perceptible change. When kept for some time under oil of vitriol it evolves vapours of hydrochloric acid.[3] When exposed to air and light, it is decomposed,—chlorine and hydrochloric acid with other products, are evolved. When kept under water, it remains unchanged. It does not decompose iodic acid or iodide of potassium.

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[1] *Pharmaceutical Journal*, vol. xv. p. 315.

[2] Gmelin's *Chemistry*, vol. vii. p. 347.

[3] Dumas, *Traité de Chimie*, t. v. p. 595.

CHARACTERISTICS.—Chloroform is characterised by its high specific gravity, its great volatility, peculiar taste and odour, non-inflammability, its insolubility in water, and its perfect solubility in alcohol and ether. It is precipitated from these solutions on the addition of water. It sinks in water, floats on sulphuric acid, but sinks in a mixture of equal parts of sulphuric acid and water. Its solvent powers are very remarkable.[1]

COMPOSITION.—According to Dumas, the following is the elementary composition of chloroform:—

	Atoms.	*Eq. Wt.*	*Per Cent. Dumas.*
Carbon	2	12	10·24
Hydrogen	1	1	0·83
Chlorine	3	108	88·93
Chloroform	1	121	100·00

If the existence of the compound radical formyle ($Fo = C^2H$) be assumed, then chloroform would be a terchloride of formyle, $FoCl^3$ or C^2H,Cl^3. Asuming the specific gravity of the vapour to be 4·13, then, in every two volumes of chloroform vapour, there are two volumes of carbon vapour, one volume of hydrogen gas, and three volumes of chlorine gas.

When passed through a tube, heated to redness, the vapour is decomposed. This is the process employed for its detection in the blood or in the contents of the stomach. The vapour, according to Liebig, is resolved partly into sesquichloride of carbon and hydrogen, and partly into carbon, *hydrochloric acid*, and *chlorine*. ($2C^2H,Cl^3 = C^4Cl^6 + 2H$ and $C^2H,Cl^3 = C^2 + HCl + Cl^2$) Tests for chlorine and hydrochloric acid are applied at the mouth of the tube, or in its interior; and the detection of these gases is supposed to indicate the presence of chloroform. We have tried this process on blood taken from a youth who had died from the effects of chloroform vapour. The blood had no odour of chloroform, and there was not the least indication of the presence of this substance in it when the distilled vapour was thus decomposed by heat.

PURITY.—When shaken with sulphuric acid, pure chloroform should undergo no change of colour. When evaporated on the hand, it should evolve no unpleasant odour. It should sink readily in water in rounded globules, without imparting any opalescence to the liquid. This appearance would indicate the presence of alcohol. If alcohol be present even in small quantity, it will be indicated by a thin opaque film around the globule. Another test for the presence of alcohol has been proposed, namely, the addition of a portion of the suspected sample to a mixture of bichromate of potash and sulphuric acid. If alcohol be present, a green colour is acquired by the liquid. M. Besnou has pointed out that certain precautions are required to obtain satisfactory results with this test.[2] We have found very pure chloroform give a slight greenish colour. This gentleman has suggested that the specific gravity will not only detect the adulteration with alcohol, but to a certain extent indicate the proportion. In experimenting with commercial chloroform, he has obtained the following results:—

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[1] See *post*, Pharmaceutical Uses.

[2] *Journal de Chimie Médicale*, 1854, p. 734.

Sp. Gravity.	*Alcohol, Per Cent. (by Measure.)*	*Sp. Gravity.*	*Alcohol, Per Cent. (by Measure.)*
1494	0	1477	5
1490	1	1460	10
1487	2	1426	20
1484	3	1409	25

Hence it follows that chloroform, mixed with ten per cent. of alcohol, loses 34 in density; and, with 20 per cent., 68.

The proportion of alcohol in chloroform may also be determined by agitating it with an equal measure of distilled water in a graduated tube, and noticing the loss. The chloroform not being perceptibly soluble in water, should not undergo any change in volume. This is on the principle of washing ether.

Alcohol may be present in chloroform as a result of its passing over during distillation. Its presence affects the qualities of the sample in reference to inhalation. It may be sometimes present as an adulteration.

Ether is not commonly found as an impurity; its presence may be detected by the remarkable difference which it produces in the specific gravity. Water cannot be used as an adulterating ingredient, as it either gives a milkiness to the liquid, or there is a separation into two layers. Potassium placed on chloroform does not produce combustion; if water be present, or weak spirit, there is immediate combustion. If any traces of sulphuric acid remain in it, as a result of its use in rectifying it, this impurity may be discovered by adding a salt of baryta to water with which it has been agitated.

Chloroform sometimes presents a pink colour, which, according to the observation of the author, depends on the presence of manganese, either as an impurity in the chloride of lime, or as a result of the rectification of the products of distillation by peroxide of manganese, as recommended by Gregory.[1] Under exposure to air and a strong solar light, chloroform undergoes changes which have been already described. It acquires a yellowish colour; and when the stopper is removed, there is a sudden burst of acid vapour, which we have found to be chiefly hydrochloric acid, the liquid being at the same time strongly acid. According to Gregory, chlorine is also set free. It has been elsewhere stated, on the authority of Mr. Scanlan, that chloroform rectified by sulphuric acid is particularly liable to change.

Physiological Effects.—*a. On Vegetables.* Dr. Simpson found, in experimenting with chloroform vapour on the sensitive plant (*Mimosa pudica*), that when it was too strong or too long continued the plant was destroyed. When it was weaker and applied only for a few minutes, the leaflets in some plants closed as when irritated mechanically, and did not expand again for an unusual length of time. In other plants under exposure to the chloroform vapour, no closure of the leaflets took place,

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[[1] See paper by Dr. Pereira, in *Pharmaceutical Journal* for January, 1852, On a Remarkable Specimen of Decomposed Chloroform.]

and in a few minutes the plant became so anæsthetised that the mechanical or other irritation of the leaflets or stalks did not produce any of the common movements, nor did their irritability become restored for a considerable time afterwards.[1]

β. *On Animals.* Chloroform vapour affects all animals, even insects and mollusca, either locally or generally according to the mode in which it is applied. The mammalia are affected by the vapour much in the same manner as the human subject. Dr. Simpson has minutely examined the *local* effects of this vapour on the different classes of animals, and he has arrived at the following conclusions.[2]

"1. In animals belonging to the class of Articulata, complete local and limited anæsthesia can be produced by the local and limited application of the vapour or liquid of chloroform to individual parts of the body of the animal.

"2. In Batrachian reptiles, the tail, or an individual limb, can be affected in the same way with local anæsthesia, by the local application of the chloroform; but, in addition, general anæsthesia of the animals usually results in a short time, in consequence of the chloroform absorbed by the exposed part coming to affect the general system.

"3. In the smaller mammalia a single limb, or even the whole lower or pelvic half of the body, can be rendered anæsthetic by local exposure of these parts to the influence of chloroform.

"4. In the human subject partial, and perhaps, superficial, local anæsthesia of a part, as the hand, can be produced by exposing it to the strong vapour of chloroform; but the resulting degree of this local anæsthesia is not sufficiently deep to allow the part to be cut or operated upon without pain.

"5. Any agent possessing a stronger local benumbing, or an anæsthetic influence, would probably be dangerous, by its acting too powerfully on the general economy, before the local anæsthesia was established to a depth sufficient for operating.

"6. Artificial local anæsthesia, from any known anæsthetic agents, seems objectionable in any part intended to be operated upon, in consequence of the vascular congestion and injection which attend upon and accompany this local anæsthesia.

"7. There are few operations in which there is not previously a local broken surface; and the application of chloroform, &c. to such a surface, would be far too painful to be endured, no small degree of suffering sometimes arising from even the exposure of the unbroken skin to its action."

γ. *On Man, in the liquid state.*—In large doses chloroform appears to produce such effects as might be mistaken for poisoning by alcohol. We have elsewhere recorded the case of a man who had swallowed four ounces of chloroform.[3] After taking this large dose the man was able to walk for a considerable distance, but he subsequently fell into a state of coma. The pupils were dilated, the breathing stertorous, the skin cold, the pulse imperceptible, and there were general convulsions. He recovered in about five days.

When given alone, the liquid chloroform may be mixed with water and a little mucilage. Owing to the difficulty, however, of mixing it with water, gum, oil, or yolk of egg have been respectively proposed as vehicles, and have found their supporters.[4] In general the

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[[1] *Anæsthesia, or the Employment of Chloroform and Ether in Surgery, Midwifery, &c.*, by J. Y. Simpson, M.D. F.R.S.E., &c., p. 228.]

[2] *Op. cit. loc. cit.*

[[3] This case was communicated to us by Mr. Jackson of Sheffield. See *Medical Gazette*, vol. xlvii. p. 675.]

[4] Some formulæ of this kind will be found in the *Pharmaceutical Journal*, vol. xv. p. 563.

alcoholic solution has been extensively employed, under the name of Chloric Ether.[1]

Dr. Hartshorne, of the Pennsylvania Hospital, made many trials of chloroform in large doses in water. In a case of painful *neuralgia* of the head, the patient took seventy-five drops at night, slept better than she had done for weeks even after inhaling chloroform or ether, was unusually comfortable the next day, and continued to improve under its use. It is stated to have answered admirably as a substitute for Dover's powder in a case of *rheumatism*, and afforded prompt relief in a case of *flatulent colic*. Dr. Strother administered one hundred drops to a *cholera* patient with the effect of relieving the cramps, the vomiting, and all the other alarming symptoms for several hours, during which time other remedies were applied, and the patient recovered. It was given to a patient labouring under *traumatic tetanus* by Dr. Brickell, of New Orleans, in doses of a hundred drops, but without any very decided advantage; and the disease afterwards yielded to large doses of sulphate of quinine. Dr. Warriner states that it produced immediate relief in a case of sick headache, and in a case of *dysmenorrhœa* depending on uterine neuralgia.[2]

Chloroform was used by M. Guillot as an antispasmodic in cases of *asthma*, in 1844; and Dr. Formby employed it in cases of *hysteria*, at a still earlier period. According to Dr. Christison, it is serviceable for arresting chronic vomiting depending on nervous causes, such as that which occurs in pregnancy. In *otalgia*, in the case of an adult who suffered from severe pain in the ear which had resisted leeches and morphia, Professor Malmsten, of Stockholm, employed chloroform as a liquid — twelve drops being dropped into the affected ear. In a few minutes the pain subsided.[3]

DOSE.—The dose internally may be from five to twenty minims or more. The physicians of the United States have been in the habit of prescribing it in much larger doses.

CHLOROFORM VAPOUR.—*Effects.*—After the first two or three full inspirations, there is a feeling of warmth and excitation radiating from the chest to the extremities. This is followed by whirring or whizzing noises in the ears, a sensation of vibratory thrilling and benumbing throughout the body. There is excitement of the brain, with exhilaration, and phenomena similar to those produced by the protoxide of nitrogen. There is loss of sensation and motion, and at last of consciousness. Sleep, more or less profound, is induced, during which the mind is either passive, for nothing is remembered, or it continues active as in dreams.[4] Dr. I. C. Atkinson records, as the result of observation on himself, that the senses are successively obliterated during the inhalation of chloroform. "The sense of hearing, under a moderate inhalation of chloroform, conveys correct modulations of sound to the brain; for if there be a musical turn of mind, a whole tune, after a prompter has led the way, is pleasingly sung or whistled through, no error in time being perceptible. During the gradual obscuration of the senses the mind is only conscious of the retention, to the latest, of the faculty of hearing, the senses being *obliterated one after another*, but not *simultaneously*. The gradual extinction of the senses possibly depends on the origin and distribution of the cerebral nerves. The actual effects on the senses generally are not altogether dissimilar. Chloroform certainly increases the sensitiveness of the ear. The body may remain quiet and insensible to pain; the other senses may be gradually declining; but the sense of melody has a concentrated charm, which in no other state can be enjoyed with the like satisfaction. The five senses appear to be successively obliterated in the following order:—1. Taste; 2. Smell; 3. Feeling; 4. Sight; 5. Hearing."

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[1] See *post*, Æther Chloricus.

[2] *Transactions of American Medical Association*, vol. ii. p. 127.

[3] *Dublin Quarterly Journal*, Nov. 1856, p. 500.

[[4] That chloroform produces delusions is proved by daily experience; but these delusions occasionally assume a more serious character than that of merely transient excitement. Thus a dentist in New York was convicted under a charge of having grossly illused a young lady while under the influence of chloroform, upon her statement. It was the opinion of other dentists and medical men that this conviction was unjust — that the accusation was made under a delusion; and many instances of strange delusions were adduced by them in support of the opinion.]

ADMINISTRATION AND DOSE.—Different opinions exist, not only as to the best mode of administering chloroform vapour, but as to its operation on the system. Dr. Simpson, whose opinions are entitled to respect as the discoverer of the anæsthetic properties of the liquid, as well as from the large experience he has had in administering it to persons presenting every conceivable variety of temperament, age, and state of health, contends—

> "1. That chloroform vapour must always be exhibited as rapidly and in as full strength as possible, if you desire to have its first or exhilarating stage practically done away with, and excluded; and you effect this by giving the vapour so powerfully and speedily as to apathize the patient at once. If you act otherwise, and give it in small or slow doses, you excite and rouse the patient in the same way as if nitrous-oxide gas were exhibited. 2. In order that the patient be thus brought as speedily as possible under its full influence, the vapour should be allowed to pass into the air-tubes by both the mouth and nostrils,—and hence all compression of the nostrils, &c., is to be avoided. 3. The vapour of chloroform is about four times heavier than atmospheric air. And hence, if the patient is placed on his back during its exhibition, it will, by its mere gravitation, force itself in larger quantities into the air passages than if he were erect or seated. As to the best instrument for exhibiting the chloroform with these indications, the simple handkerchief is far preferable to every means yet adopted. It is infinitely preferable to any instrument yet seen, some of which merely exhibit it by the mouth and not by the nostrils, in small and imperfect, instead of full and complete doses; and with instruments so constructed, there is no doubt whatever that failures and exciting effects would ever and anon occur. Besides, inhaling instruments frighten patients, whilst the handkerchief does not; and mental excitement of all kinds, from whispering and talking around the patient, is to be strictly avoided, if possible. As to the quantity required to be applied to the handkerchief, it has been stated, that the average dose of a fluid drachm was generally sufficient to affect an adult; but I have latterly seldom measured the quantity used. We must judge by its *effects*, more than its quantity. The operator gathering his handkerchief into a cup-like shape in his hand, should wet *freely* the bottom of the cup (so to speak), and if the patient is not affected in a minute or so, he should add a little more. It evaporates rapidly; and you must not wet your handkerchief, and then delay for a minute or more in applying it. It must be applied immediately. Not unfrequently, when the patient was just becoming insensible, he will withdraw his face, or forcibly push aside the handkerchief. If you *then* fail to reapply it to his face and keep it there, you will be liable to leave him merely excited. But probably two or three inhal-

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[1] *Lancet*, March 15, 1855.

> ations more will *now* render him quite insensible. The simplest test of its full and perfect effect is some noise or stertor in the respiration. Cease it as soon as this is fully set in. But reapply it, of course, from time to time, if it is wished to keep up its effects."[1]

A committee appointed by the American Medical Association to report on the administration of this vapour, consider:—

1. That the recumbent position is the most favourable for the inhalation of chloroform, and in obstetrical practice it should be administered in no other.[2]

2. No inhaling apparatus should be employed. A common pocket handkerchief folded in the form of a compress or sponge, applied so as to cover both the nostrils and mouth, is the best vehicle. With this there is no danger of the exclusion of atmospheric air, an accident to which we may be exposed in a greater or less degree with ordinary inhalers. The handkerchief or sponge is at the same time much less formidable in appearance and much more readily applied.

3. Upon the handkerchief or sponge may be poured a drachm of chloroform if the full anæsthetic effect be desired, or one-half or one-third of this quantity if a less decided result only is sought for,—the effect, however, to be the guide, rather than the quantity used, as very different quantities are required in different cases.

4. The inhalation should never be continued after the full anæsthetic effect has been produced, which can generally be recognised at once by the sonorous or stertorous sleep. Nor should it ever be given after the pulse begins to fail in frequency and force. It is advisable that the pulse should never be allowed to fall between 60 and 65 per minute; when it reaches this point the sponge should be removed and atmospheric air alone be inhaled until the pulse recovers its tone. It is also to be borne in mind that the depressing stage of chloroform continues to *increase* for several seconds after it has been withdrawn; differing in this respect from ether, which does not appear to be cumulative in its operation, for under the influence of ether the patient never becomes more depressed than at the moment of ceasing the inhalation.[3]

Dr. Snow, who has had considerable experience in administering chloroform vapour in this metropolis in surgical and obstetric practice, prefers the use of an inhaler so constructed as to allow the vapour to pass both by the nose and the mouth into the lungs, the patient being made to breathe through a mask.[4] By the aid of this instrument the amount of vapour inhaled, and its degree of admixture with air, can be easily controlled.

The observations made by Dr. Snow with respect to the action of chloroform on the lower animals, as well as the facts he has collected with regard to the deaths which have taken place in the human subject while chloroform was being inhaled, have led him to adopt the following conclusions:—

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[1] *On Chloroform in Surgery*, *Anæsthesia*, pp. 29, 30.

[2] The recumbent or semi-recumbent posture, on the back or side, is that generally advised. Dr. Snow, however, does not object to the sitting posture, and has preserved notes of 647 cases in which he has given chloroform to patients sitting in a chair (*Lancet*, Oct. 20, 1855). If the respiration be carefully watched, there is no very obvious reason why the sitting posture should be a source of danger. We have ourselves witnessed its administration in this posture without unfavourable consequences.

[3] *Transactions of the American Medical Association*, vol. i. p. 230.

[4] The reader will find a description of this inhaler in the *Medical Gazette*, vol. xlii. p. 843. That, even when skilfully used, it does not guarantee the operator from a fatal accident, is proved by the fact, communicated to us, that Dr. Snow himself lost a patient while using it. At some of the London Hospitals preference is given to the use of a piece of lint, on which from ʒi. to ʒiss. of chloroform is poured, and this is wetted from time to time with half a drachm of chloroform.

"1st. Chloroform vapour, if it be inhaled in large proportion with atmospheric air, destroys life by paralysing the heart.

"2d. In smaller proportions, but long continued, it produces death apparently by the brain, and by interfering with the respiratory function. In such cases the heart is found to beat after respiration has ceased.

"3d. Chloroform vapour, if it be blown upon the heart, paralyses it immediately.

"4th. Atmospheric air, loaded with from 4 to 5, or even 6 per cent. of chloroform vapour, may be safely administered, inasmuch as that mixture will not act directly upon the heart, but will give timely notice of its increasing effects in modifying the normal discharge of the functions of life. The average time occupied in producing insensibility is from three to four minutes.

"5th. The proportion of as much as from 8 to 10 per cent. of vapour of chloroform to atmospheric air is a dangerous mixture, as it suddenly charges the blood going into the heart with a poison capable of acting directly on that organ."

Dr. Snow divides all the effects of chloroform, short of the abolition of life, into five degrees or stages. It is in the third degree that there is a marked cessation, not only of all voluntary motion, but of the general sensibility of the body. As this is the state which it is desirable to reach for the purposes of an operation, he advises as a test of its existence that the eyelid should be raised, gently touching its free border. If no winking is occasioned, the operation may be commenced. The eyelid should be quite passive: the eye is usually turned up and the pupil contracted. With respect to the pupil, Dr. Snow has never observed it widely dilated or insensible to light, even when with general insensibility there was relaxation of the involuntary muscles.[1] A surgical friend informs us that, according to his observation, the first effect is to dilate the pupil; but, when complete narcotism has taken place, it becomes contracted. He also finds that the passive state of the eyelid is not so good a criterion as the pinching or touching of a limb; he has known this to rouse a patient even when the conjunctiva of the eye and eyelid had lost all sensibility. Having had much experience in the use of this agent, he recommends that attention should be paid to the state of the countenance, of the pulse, of the respiration, and the condition of the limbs. When a slightly livid colour appears in the countenance, when the pulse sinks to 50 or below, and when the respiration is feeble and shallow, the exhibition of the chloroform should be intermitted.[2] A complete relaxation of the limbs is the first satisfactory evidence that the operation may be commenced. This is, indeed, the criterion upon which operators generally rely. The insensibility begins in fifteen seconds, and is seldom postponed beyond two minutes if the vapour be properly administered.

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[1] See the papers of Dr. Snow in *Medical Gazette*, vol. xlii. pp. 333, 413, *et seq.*

[2] Dr. Christison observes that in certain unascertained constitutional circumstances excessive depression of the heart's action is apt to be produced in man. Dr. Dewar, of Torryburn, informed him that he once observed prolonged deliquium and an excessively feeble pulse produced by the inhalation of an ordinary dose; so that powerful stimulants were required for three quarters of an hour, and he was for some time apprehensive of the result. A similar case occurred to a friend of ours in this metropolis.

MODUS OPERANDI. *Poisonous Effects.*—There is no doubt that chloroform enters into the blood, and affects its colour and liquidity. The amount of carbonic acid excreted by the lungs under the influence of chloroform has been found to be diminished, showing, as in the case of alcohol and ether, that the processes of oxidation going on in the body are lessened. This does not arise from the appropriation of the oxygen in the blood by chloroform, but probably, as Dr. Snow has suggested, from an arrest of oxidation, which appears to be a property of chloroform as well as of the vapours of other volatile narcotic liquids.[1] This experimentalist has observed that the venous blood in patients under the influence of chloroform is less dark in colour than in the normal state, indicating, in his opinion, that those changes in the blood which take place in the systemic capillary circulation are diminished.

In cases in which chloroform vapour has proved fatal, the symptoms and appearances have been pretty uniform. The patient passes rapidly into a state of insensibility, with stertorous breathing. The face is pale, sometimes livid, the lips congested, the breathing slow and laborious, the surface cold, the pulse sinks, and soon becomes imperceptible at the wrist. There is complete and universal relaxation of the muscular system, including the sphincters, with entire loss of sensibility. The pupils are dilated. Death has been observed to take place with great rapidity,—not more than one or two minutes having elapsed. In one instance, in which thirty drops had been inhaled, the patient died in a minute; in another, so small a quantity as fifteen or twenty drops proved speedily fatal.[2] These and other facts show that the fatality is not so much dependent on the dose administered as on the mode in which the vapour is inhaled, and the condition of the patient at the time.

Morbid Appearances.—Congestion of the vessels of the brain and its membranes has been met with, but not uniformly; the lungs congested, or in an apoplectic condition; the heart flaccid, and the cavities frequently empty, or containing but little blood—the blood generally dark in colour, and very fluid. These are the principal appearances.

Fatal cases have been much more numerous from chloroform vapour than from ether vapour. In some of these, latent morbid conditions of the heart or brain may have led to the unfortunate result; in others, the improper mode of administering the vapour. But there have been undoubtedly cases in which, with the exercise of proper skill and care, death has still occurred. The conclusion at which we arrive, therefore, is, that notwithstanding the knowledge we now possess may enable us, with due care, to protect from death healthy persons who inhale chloroform, fatal cases will occur in certain diseased conditions of the body, even when every precaution has been taken. Thus it cannot be doubted, that when the heart is affected either with extensive disease of its component structures or of its valvular appliances, the dose of chloroform which might be perfectly safe in health may in such cases produce a fatal result. This remark especially applies to cases in which the heart is weakened either by fatty degeneration or fatty deposit, or where atrophy of its tissue and thinning of the walls of the organ have, to any considerable extent, lessened its muscular power. It unfortunately happens, too, that these conditions, and especially the former, are not always easily ascertainable during life. Again, we may expect that lesion of the brain, of an obscure character, may sometimes render the inhalation hazardous.

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[1] *Medical Gazette*, vol. xlvii. p. 626.

[2] See Table of Fatal Cases, by Dr. Warren, U.S., *Effects of Chloroform and Chloric Ether* p. 23.

On the whole, then, even with every precaution, it would seem that to give chloroform to induce anæsthesia is to introduce an additional element of danger during an operation. Experience has shown that this amount of danger is but very small; and therefore, when every care is taken, and no obvious disease can be detected in the internal organs of the patient, it may be justifiable to recommend the inhalation of chloroform, in order to secure the patient from suffering. It is impossible to estimate the proportionate amount of mortality in cases in which chloroform vapour has been exhibited. The reader will find in Dr. Warren's work, already referred to, the details of ten, in which the vapour had proved fatal. According to Dr. Snow, up to the year 1853 there had been thirty-seven deaths from this vapour.[1] Many more have been recorded since, and probably up to that date there had been many fatal cases, reports of which had not been published.

It has been stated that this vapour, when acting fatally, generally destroys life by a primary impression on the system in a few minutes. Some cases are on record which show, however, that even after apparent recovery, persons may die from the secondary effects.[2]

Dr. Snow refers the cause of sudden death from chloroform to paralysis of the heart, owing to the vapour having been inhaled in too concentrated a form. It is to be observed, however, that this is the mode in which some have advised its administration; and the results of their practice are not in accordance with this view of its operation. In Dr. Black's opinion, when the vapour is administered in a highly concentrated form, it is irrespirable, owing to its pungency; and spasm of the glottis, leading to asphyxia, is induced.[3] Dr. Black thinks that the safety of chloroform vapour "is in its inhalation; the chief danger consists not in its impregnating the blood too strongly, but in its non-inhalation. Any concentration of the vapour which can be breathed is safe; any condition of dilution which forces the patient to cough, or to hold his breath, is dangerous; and if persevered in for even half a minute, may be fatal. When deeply narcotised, the patient can inhale the chloroform in its highest concentration; but if this be forced upon him at the commencement, he will immediately experience choking or suffocation."[4]

Death from chloroform cannot, however, be referred in all cases to asphyxia, as this theory would imply. Admitting that a patient can inhale the concentrated vapour when deeply narcotised, it is clear that a persistence in its administration under these circumstances would destroy life by a directly poisonous action.[1]

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[1] See *Medical Times and Gazette*, Dec. 24, 1853, p. 665.

[2] See a paper on this subject by Dr. King, *Edinburgh Medical and Surgical Journal*, January, 1854; also a case by Mr. Lane, *Medical Times and Gazette*, June 3, 1854, p. 572.

[3] *Chloroform: How shall we ensure Safety in its Administration?* by Patrick Black, M.D. London, 1855.

[4] *Op. cit.* p. 29.

The advantages derived from chloroform vapour over that of ether consist in its more rapid and intense action, and in its not being so frequently attended with the muscular and nervous excitement produced by ether. The several stages of etherization are blended as it were into one, the full effect of chloroform being induced in from thirty to forty seconds, while an average period of four minutes may be considered as necessary to produce a like effect from ether. The quantity of chloroform required is also much smaller,—from thirty minims to a drachm being generally sufficient, and one drachm of chloroform being considered, according to the mode of administration, equal to one ounce of ether. The odour and taste of chloroform are more agreeable; the odour passes off more rapidly, and there is less bronchial irritation produced by the inhalation of chloroform than of ether.[2] These are substantially the advantages which were claimed for this agent by Dr. Simpson soon after its discovery; and experience since obtained shows that they are well founded. On the other hand, we must set against these advantages the far greater amount of mortality from its administration than from the employment of ether.

USES. *Surgical Operations.*—The uses of chloroform vapour in *surgery* may be summed up, in the language of its discoverer, in a few words:—1st, to relax the muscles in reducing dislocations, &c.; 2ndly, to avert the sufferings attendant on deep probings and other painful but necessary modes of diagnostic examination and dressing; and 3rdly and principally, to annul the pain of protracted operations by the caustic, ligature, or knife.

Examples of its use have been so frequent that there are few medical practitioners who cannot now speak from their own experience. Medical men of repute have been for some time at issue whether, on the whole, it has been productive of good or evil in surgical practice; and statistics have been profusely brought forward in order to establish both propositions.[3] Those who have opposed the employment of chloroform under any circumstances, have been prejudiced in favour of ether or of anæsthesia from cold, or have condemned the use of any anæsthetic whatever. Chloroform has now been nine years before the profession, and in spite of much violent opposition, the views of cautious and experienced surgeons, so far as we can gather them, are decidedly in its favour as an agent for annulling pain in many kinds of surgical operations. In fact, numerous operations are stated to have been performed by its aid, which could not have been undertaken without it. At the same time, all agree that it should be administered by one well skilled in its effects, and able to meet any untoward results,—that as its use is attended with a certain amount of risk, it should not be resorted to for operations of a trivial kind, and that the condition of the patient to whom it is to be administered should be closely examined and considered. With these precautions, and with the use of a pure sample of chloroform, the risk of any untoward accident is reduced to a minimum.

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[1] See a case quoted by Dr. Warren, *op. cit.* p. 58. In another fatal case (during operation), communicated to us by a friend, the heart suddenly ceased to beat *four minutes after the vapour had been withdrawn.* The digital arteries, which had been divided in the operation, suddenly ceased to let blood. The man was dead. This appears to corroborate Dr. Snow's view of the cause of death.

[2] *Report to American Medical Association, loc. cit.*

[3] We have seen three sets of statistical tables regarding the influence of chloroform vapour on the mortality from surgical operations. One set of calculations tended to prove that the mortality had been less, another that it had been greater, and a third that it had remained nearly stationary! This is enough to show that the truth cannot be arrived at by figures.

It has been found serviceable, especially in cases in which there is depression in an enfeebled state of the circulation, to administer to the patient a glass of wine or of brandy and water before giving the chloroform. We state this as a result of the experience of a distinguished surgeon.[1] All agree that no food should be taken within one or two hours of the time of inhalation, as under such circumstances vomiting is a frequent consequence of the administration of chloroform vapour.

As it has been already stated, in spite of every precaution chloroform will occasionally act very injuriously. Among the unpleasant secondary results of its administration, may be mentioned vomiting, headache, and severe collapse, from which some patients have not rallied for many hours, or even days. A surgeon of a metropolitan hospital, who takes a favourable view of the use of chloroform, has furnished us with two cases which may be considered as presenting a type of these injurious consequences. 1. This was a case of large scrotal hernia strangulated. The patient, a man aged fifty-one, had long been affected with bronchitis. Urgent dyspnœa came on soon after the operation, and the man died in twelve hours. The strangulation had existed only about eighteen hours, and there was nothing found in the post-mortem examination to account for death, except intense congestion of the lungs, amounting almost to an apoplectic condition. There was no marked dyspnœa before the operation, and the state of the lungs was considered to be due to chloroform. 2. This was a case of cancerous obstruction of the rectum, requiring an operation which was tedious and protracted,—the influence of the chloroform having been kept up for an hour. The patient, aged forty-five, had been able to take solid food up to the time of the operation; but afterwards he vomited frequently during several days: he had constant nausea, and lost all appetite for food. So far as the operation was concerned, the case proceeded satisfactorily; but the patient continued unable to take solid food, and very little food of any kind. He became emaciated,—gradually sank, and died on the fifteenth day after the operation. He inhaled an unusually large quantity of chloroform, which the operator believed was the cause of the extremely irritable condition of his stomach, and prevented his recovery afterwards.[2] This gentleman has witnessed, in other cases, this persistent irritability of the stomach as a result of chloroform vapour, and he has suggested for its avoidance that the anæsthetic state should be induced by chloroform, but subsequently maintained by the vapour of ether.

Such cases may, it is true, be regarded as exceptional, but this does not render their occurrence the less to be regretted, as no patient likes to find himself an exceptional instance.

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[1] See also *Medical Times and Gazette*, December 27, 1856, p. 652.

[2] Dr. Snow states that he has met with more or less vomiting in about one-fifth of the patients operated on, and cases of troublesome sickness in about one out of twenty-six operations. *Medical Gazette*, vol. xliii. p. 455.

Although it is impossible to predict, in any given instance, what the effects of chloroform may be, yet there are some instances in which, from the nature and effects of a severe accident, the administration appears to be contra-indicated. Such are cases of crushed or shattered limbs, attended by severe shock to the nervous system; where there is coldness of the surface, with feeble pulse, and other symptoms of collapse. No operation is performed in such a case until the patient has rallied; and even then it may be a question whether it would be desirable or proper to employ chloroform in its performance. At any rate, the mortality arising in such cases must not be set down to the use of this agent, for the patient would probably have equally sunk under any treatment, or if he had been simply left without surgical treatment.

Among the secondary evils attributed to chloroform in surgical practice, may be mentioned *pyæmia*, following surgical operations. There is reason to believe, however, that fatal cases of pyæmia were quite as frequent before as after the introduction of chloroform, and as a cause of death that it had been frequently overlooked.

In *Military Surgery* the same conflict of opinion exists as to the safety or danger of using this agent. The Crimean campaign might be supposed to have furnished ample opportunity of arriving at an accurate knowledge of the safety and utility of chloroform or the contrary, as an aid to surgery. Dr. Mouatt gives the results of his experience in the following conclusions:[1] — "1st. There are states of shock, or depression, from loss of blood following extensive injury, such as the loss of a thigh high up, or the arm at the axilla, in which chloroform may destroy life in various ways. 2nd. There are likewise cases in which the patient never fairly rallies, but sinks gradually, without any effort at reaction: these cases are never returned as deaths from chloroform. 3rd. I cannot subscribe to the kind of argument sometimes used to justify its indiscriminate use—viz., that the invariable absence of pain to the patient, and advantage to the surgeon, fully counterbalances the risk of an occasional fatal termination. In trifling injuries, life is too precious to be thus trifled with; it is opposed to all moral laws; nor can the opinions of hosts of authors, dead or living, make it right in such cases." Dr. Gordon, in charge of the second division, coincides in opinion with Dr. Mouatt, and contrasts the favourable results of amputations performed during the Punjaub campaign without chloroform, against those performed in the Crimea with chloroform.

Let us contrast with this the experience of Dr. Macleod[2]—"During the whole course of the war (in the Crimea) there has been only one death which can, with any fairness, be said to have arisen from its effects (the effects of chloroform). It is impossible to say in how many cases it has been used: but as very few surgeons indeed failed to employ it on all occasions, it must have been administered to a very large number of patients." Mr. M'Whinnie states that he had received an equally satisfactory account of its action from a Russian officer; and that M. Baudens reported to the Academy of Sciences, that chloroform had been administered in the Crimea in 25,000 instances; and M. Scrive, the

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[1] *Lancet*, July 19, 1856.

[2] *Edinburgh Medical Journal.* See Introductory Address, by A. M'Whinnie, F. R. C. S. 1856.

Physician in Chief of the French army, has affirmed that no fatal case had occurred.[1]

Tetanus. — Chloroform vapour has been used in cases of traumatic tetanus with temporary relief, generally speaking. Dr. Shipman reports a case, not very severe, in which it appears to have succeeded in removing the symptoms, when morphia and other remedies had failed. In this case ten drops on a linen handkerchief were given every ten minutes. Others have not been successful, nor is it easy to perceive how the cause of the disease should be removed by the inhalation of the vapour. In a case of traumatic tetanus which occurred at Guy's Hospital, in February, 1856, in which the disease occurred on the seventh day from a laceration of the finger, a fair trial was given to chloroform vapour. When the man was admitted on the ninth day after the injury, the usual symptoms were developed, with paroxysms at intervals affecting the muscles of the trunk and lower extremities, induced by the slightest causes. Chloroform was almost incessantly administered from two o'clock, on the day of admission, until within an hour of death, which took place the following day. The patient was allowed to recover several times from the effects of chloroform; but Mr. Wallace, the dresser, observed that so soon as he had recovered, a paroxysm came on, and he was in the greatest agony, crying out for a repetition of the inhalation, which always relaxed the spasm and temporarily allayed his sufferings. When fully under the influence of chloroform, it was observed that the pupil was greatly dilated, but as he recovered, it gradually became contracted and remained so until the inhalation was repeated. He sometimes remained a quarter of an hour under its full influence. He died quietly, probably from exhaustion, during a remission. About a pint of chloroform was consumed in the treatment. Although there was nothing to indicate a curative effect, it is clear that the use of the vapour greatly alleviated the sufferings of the patient. The same temporary benefit has been observed in *hydrophobia.*

The above case corroborates the statement of Dr. Simpson that very large quantities of chloroform may be safely used, provided the vapour be judiciously administered, and the effect be closely watched. He himself has used eight fluidounces in thirteen hours in a case of labour.

Vesical Calculus. — In a case of lithotrity, in which there was such excessive irritability of the bladder that a tablespoonful of water could not be introduced,—chloroform vapour produced such a beneficial effect, that while the patient was under its influence four ounces of warm water were injected, the stone was then broken, the bladder washed out, and the patient recovered without any untoward symptom.

Ophthalmic Surgery.—Chloroform has been found particularly advantageous by Mr. Bowman, Mr. Lawrence, Mr. Walton, Mr. Cooper, and others, in operations for congenital cataract, or other surgical operations upon the eyes of children, by its securing steadiness of the eyeball. For the same reason it is of great service in operating upon the eyes of adults deficient in moral courage. In adults, however, greater caution is required in its use, as the vomiting that occasionally follows interferes with the success of the operation. The prolonged depression that sometimes ensues is also a condition unfavourable to the restoration of the organ. Mr. Haynes Walton[1] finds that in operations for cataract, under the influence of chloroform, the lens does not start forward so freely after section of the cornea, as when the patient is conscious. Where the patient has sufficient strength of mind and resolution to maintain steadiness of the eyeball, it is preferable to operate without chloroform.

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[1] *Op. cit.* p. 30.

Hernia.—Strangulated hernia is very frequently reduced, and the surgical operation for its relief is often avoided by the use of chloroform.

Obstetric Practice.—Chloroform vapour has been most extensively used in midwifery for diminishing or annulling the pains attendant on labour. Its great advantages in this branch of practice have been set forth by Dr. Simpson, Dr. Murphy, and others. Dr. Ramsbotham and Dr. Robert Lee are, however, opposed to its use under any circumstances.

In Medicine.—The vapour has been used in medical practice chiefly as an antispasmodic, and in many instances with great benefit; in other cases it has been employed as a diffusible stimulant, sedative, or narcotic.

Hooping Cough.—Chloroform has been found useful in abating the severity of the paroxysms, and apparently in shortening the duration of the disease. It has, in these cases, been inhaled from a few drops to half a drachm, sprinkled on the hand or on a folded handkerchief, and its vapour largely diluted with the air.[2]

Neuralgia.—Chloroform vapour has also been advantageously employed in neuralgia, in spasmodic asthma, in spasmodic croup, in puerperal convulsions, and various other spasmodic affections. In neuralgic affections of the sciatic nerve, chloroform has been used topically by Dr. Shipman with complete success in two cases.[3]

Convulsions in Infants.—M. Marotte[4] relates the case of an infant, eleven months old, suffering from convulsions, with spasm of the glottis, during dentition. Chloroform vapour was cautiously administered at intervals, with success. In convulsions depending on cerebral congestion, Professor Malmsten, of Stockholm, has found the inhalation of chloroform beneficial in arresting these convulsions when ordinary remedies had failed. Twenty drops were placed on a folded handkerchief, and held at a distance of an inch and a half from the child's nose. In a very short time the convulsions had ceased. On a slight recurrence the handkerchief was again used with permanent benefit.[5] Dr. West has also found the inhalation of chloroform to cut short fits of convulsions—thereby saving the strength and sometimes even the life of the patient—leaving, however, the cause of the convulsions untouched.

Chorea.—The sleep produced by chloroform has been found to exert a certain influence over this malady.[6]

Insanity.—In cases of insanity attended with maniacal excitement, it has allayed the violence of the paroxysms; but, as under ether-vapour, the relief has been only temporary.

Uterine Affections.—Dr. Hardy, of Dublin,[7] has applied the vapour of chloroform within the uterus by means of an instrument consisting of a metallic chamber, at one end of which a valve is attached to the gum-elastic bottle. A sponge, dipped in chloroform, is placed in the metallic chamber, and then, by pressing on the elastic bag, the vapour is expelled through the pipe. This mode of application is said to have been found beneficial in carcinoma, pruritus, &c.

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[1] *Med. Times and Gaz.* Oct. 20, 1855.

[2] Churchill, *Diseases of Children*, Dublin, 1850, p. 223.

[3] *Trans. Amer. Med. Assoc.* vol. iii. p. 359.

[4] *Arch. Gen.* Apr. 1855; quoted in *Br. and For. Med. Chir. Rev.* July, 1856, p. 240.

[5] *Dub. Quart. Journ.* Nov. 1856, p. 498.

[6] *Bull. Gen. de Thérap.* March, 1855, quoted in *Br. and For. Med. Chir. Rev.* July, 1856.

[7] *Br. and For. Med. Clin. Rev.* April, 1854, p. 586.

Lead Colic.—M. Aran, physician to the Hospital St. Antoine, Paris, has obtained the most satisfactory results from the internal administration, and external application of chloroform. The doses have been from twenty to fifty drops, given at short intervals. The medicine has also been administered in the same doses by enemata.[1]

In Fissure of the Anus.—M. Chapelle, believing that fissure of the anus is of a neuralgic character, has been induced to try the effect of the local application of chloroform (diluted with half its quantity of alcohol), and has met with complete success. The proportion of chloroform may be increased or diminished according to the susceptibility of the patient, and the mixture is applied upon a water-colour brush, whence the fluid is to be allowed to be squeezed out by the contraction of the sphincter. The sharp pain which results is of very short duration.[2]

PHARMACEUTICAL USES.—Chloroform may be used advantageously as a solvent. It dissolves most resins, even Copal resin, with great facility, amber (forming the usual amber varnish employed in photography), camphor, caoutchouc, and gutta percha. It readily dissolves also wax, iodine, and bromine, and, according to Liebig, phosphorus and sulphur. It also dissolves the vegetable alkaloids. M. Rabourdin has employed it for the separation of atropia from the juice of the leaves of belladonna, and for procuring quina, cinchonia, strychnia, and other alkaloids from extracts containing them. As it is insoluble in water, it falls to the bottom of the vessel, carrying the alkaloid with it. This is afterwards obtained by evaporating the chloroform. It equally separates bromine and iodine, when pure, from their aqueous solutions.[3]

A solution of gutta percha in chloroform, when made of the consistency of melted glue and applied by a brush, may be in some instances used as an economical substitute for collodion—the ethereal solution of gun cotton. It does not evaporate with the rapidity of collodion. A weak solution might be used for giving a thin coating of gutta percha to pills, so as to prevent taste.

ANTIDOTES.—In cases of poisoning by the vapour of chloroform, the following points of treatment should be attended to. When the pulse and respiration are suspended the patient, if not so already, should be placed in a horizontal posture, cold air should be fanned across the face, and cold water should be applied to the head. There should be a free passage of air to the mouth and nostrils, inflation of the lungs with air or oxygen gas by any of the usual methods adopted in asphyxia, and there should be at the same time forced movements of the chest to imitate respiration. Heat and frictions may be applied to the chest and abdomen, and stimulants to the nostrils.[4]

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[1] *Lancet*, Jan. 27, 1855.

[2] *Med. Times and Gazette*, Feb. 21, 1857, p. 197.

[3] See *Medical Gazette*, vol. xl. p. 1119.

[4] See Warren, *On Chloroform and Chloric Ether*, p. 50.

ÆTHER CHLORICUS, *Tinctura Chloroformi*. This is a solution of chloroform in rectified spirit. Unfortunately there is no uniformity of strength in this preparation. In the United States two varieties are recognised; the chloric ether of commerce, consisting of one part of chloroform to *fifteen* of alcohol (·840), and the other more concentrated, composed of one part of chloroform to nine parts of alcohol. The last-mentioned proportions are those which, as we are informed, are used at the London Apothecaries' Hall. Dr. J. C. Warren has recommended a still stronger preparation under the name of strong chloric ether, containing one part of chloroform to two parts of alcohol.

CHARACTERISTICS.—Chloric ether has a fragrant odour, and a hot fragrant taste. It is neutral to test paper. When added to water it produces a milkiness, and the chloroform separates. Its specific gravity is much lower than that of chloroform. When a few drops are applied to the skin, it is more irritating and evaporates much more slowly than a similar quantity of chloroform. Unlike chloroform, it may be readily ignited: it burns with a strong yellow flame, somewhat resembling that of ether, but depositing more carbon on cold substances placed within it. Its produces an intense green colour with bichromate of potash and sulphuric acid.

USES.—Chloric ether has been used with advantage as a substitute for the ethers, and is found to possess equal efficacy as a stimulant and antispasmodic. The dose for an adult is from ♏xx. to ♏xl. two or three times a day. Its flavour is preferred by most persons to that of the ethereal preparations, and it may be advantageously prescribed when objection is made to the latter form of stimulant.

The vapour of chloric ether has been much used as an anæsthetic, both in this country and in the United States. It is considered to possess the advantage of greater safety than chloroform; but, on the other hand, there are disadvantages belonging to it which have prevented it from taking the place of chloroform. Dr. Snow has fully pointed out the objections to its use.[1] Among these may be mentioned the unequal conversion of the two liquids to vapour in a given period of time. The chloroform evaporates chiefly with the first portion of spirit, and when a little more than half the liquid has been used, the remainder contains very little chloroform, and is therefore of no use for inhalation.—ED.]

ORDER LXXII. GUTTIFERÆ, *Jussieu*.—THE MANGOSTEEN TRIBE.

CLUSIACEÆ, *Lindley*.

CHARACTERS.—*Sepals* 2 or 6, usually persistent, round, frequently unequal, and coloured; æstivation imbricated. *Petals* hypogynous, 4 to 10. *Stamens* hypogynous, indefinite or rarely definite, distinct, or variously united to the base: *filaments* unequal; *anthers* adnate, introrse or extrorse, sometimes very small, sometimes unilocular, and sometimes opening by a pore. *Torus* fleshy, occasionally 5-lobed. *Ovary* solitary, 1- or many-celled; *ovules* solitary, or several in each cell, erect, or ascending, or numerous, and attached to several placentæ; *style* usually 0 or very short, seldom conspicuous; stigma speltate or radiate. *Fruit* capsular or fleshy, or drupaceous, 1- or many-celled, valvular and septicidal, or indehiscent. *Seeds* definite, in a pulp, apterous, often arillate; *testa* thin and membranous; *albumen* none; *embryo* straight; *radicle* small next the hilum; *cotyledons* large, thick and fleshy, often cohering.—*Trees* or *shrubs*, sometimes parasitical. *Juice* resinous. *Leaves* exstipulate, always opposite, coriaceous, with a strong midrib, and many oblique lateral parallel veins. *Flowers* articulated with their peduncle.—(Wight and Arnott.)

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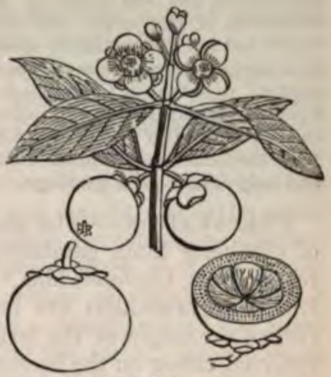
[1] *Medical Gazette*, vol. xliii. p. 984.

PROPERTIES.—The species all abound in a viscid, yellow, acrid, and purgative gum-resinous juice resembling Gamboge (*Lindley*). Several species of *Garcinia* yield edible fruits. The fruit *G. Mangostana* (fig. 88.) is the most delicious of East Indian fruits, and is "the only fruit which sick people are allowed to eat without scruple."

FIG. 88.



Garcinia Mangostana.

323. GARCINIÆ SPECIES INCERTA, *L.*—THE GAMBOGE PLANT.

Hebradendron cambogioides, *Graham, E. D.*—Cambogia Gutta, *Linn.*—Stalagmitis cambogioides, *Moon.*

Sex. Syst.[1] Monœcia Monadelphia.

(Gummi resina, *L.*—Gummy-resinous exudation, *E. D.*)

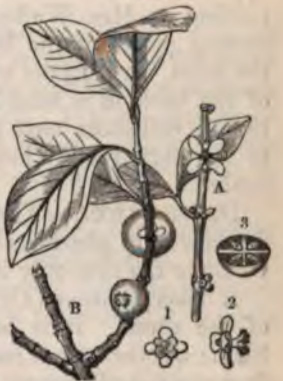
HISTORY.—The first notice of gamboge is by Clusius,[2] in 1605. He received this gum-resin in 1603 from Peter Garet, of Amsterdam. It had been brought from China by Admiral van Neck and his companions, and its oriental name was said to be *Ghittaiemou.*

[BOTANY. **Gen. Char.**—*Flowers* polygamous. *Stamens* more or less united. *Anthers* opening longitudinally. *Fruit* succulent, 4- to 10-celled.

Hab.—Ceylon, Indian Archipelago.

The annexed cut represents the plant still adopted in the Edinburgh and Dublin Pharmacopœias as that yielding gamboge. The London College have agreed with Dr. Christison in considering the distinctive characters given by the late Dr. Graham insufficient to authorise a generic distinction, and so to separate the plant described by him from the genus Garcinia. The true gamboge plant appears to have been possessed by Dr. Almeida, of Singapore, who received it from Siam direct. It has not, however, been fully described.—ED.]

FIG. 89.



Hebradendron cambogioides.

A. Male flowering branch.
1. Back view of a flower.
2. Side view of the calyx and column of stamens.
B. Fruit-bearing branch.
3. Section of fruit with its four seeds.

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[1] As the female flowers have not yet been examined, the true place of this plant in the sexual system must at present be doubtful. Linnæus puts his genus *Cambogia* in *Polyandria Monogynia.*

[2] *Exot.* lib. iv. cap. viii. p. 82.

The *Stalagmitis Cambogioides*, Murray,[1] L.; *S. Cambogia*, Persoon D. does not really exist. The specimen, which has been described as such, is in the Banksian Herbarium, and was found by Mr. Brown[2] to consist of two plants (*Xanthochymus ovalifolius* of Roxburgh, and *Hebradendron cambogioides* of Graham), the union of which had been concealed by sealing-wax. As it appears, according to Dr. Christison,[3] that the gamboge of Siam is "as nearly as possible identical in composition and properties" with that of Ceylon, it is probable that both are obtained from the same, or some nearly allied species. Indeed it has been suggested that the plant may have been carried from Siam to Ceylon: for the Bhoodist religion is supposed to have passed from the former to the latter country, and with it the practice of painting the temples and holy dresses with gamboge.

PREPARATION.—The only account which we possess of the method of obtaining Siam gamboge, is that given to König by a Catholic priest residing at Cochin-China.[4] According to this statement, when the leaves or branchlets are broken, a yellow milky juice issues *guttatim* (hence the origin of the term *Gummi Guttæ* applied to gamboge), and is received either on the leaves of the tree, or in cocoa-nut shells, and from thence is transferred into large flat earthen vessels, where it is allowed to harden during the summer season, and is afterwards enveloped with leaves. The cylindrical or pipe variety receives its form by being run into the joints of the bamboo while it is in the liquid state.[5] A few years since there was an importation of gamboge in the bamboo cylinders (*gamboge in the bamboo*). Each cylinder or stem was about twenty-one inches long and one inch and a half in diameter, closed at the lower end by the transverse partition of the nodus, and at the upper by a piece of oil-skin. In Ceylon, gamboge is obtained by wounding the bark of the tree in various places with a sharp stone, when the flowers begin to appear. The cream-like juice which exudes hardens in the sun.[6] According to Mrs. Walker, the Cingalese method of collecting it is "by cutting pieces of the bark completely off, about the size of the palm of the hand, early in the morning. The gamboge oozes out from the pores of the bark in a semi-liquid state, but soon thickens, and is scraped off by the collectors next morning, without injury to the tree, the wounds in the bark readily healing, and becoming fit to undergo the operation again."[7]

DESCRIPTION.—Two kinds of gamboge (*cambogia; gummi-guttæ*) are described by pharmacological writers—viz. the Siam and the Ceylon. Of these the first only is known in commerce.

1. **Siam Gamboge** (*Cambogia Siamensis*, Ph. Ed.)—This is the *gamboge* of the shops. It is brought to this country sometimes direct from Siam; at other times indirectly by way of Singapore, Penang, or Canton. It comes over in boxes, cases, or chests. [The average yearly importations in the ten years from 1835 to 1844 amounted to 126 chests, of which 57 chests of about one and a half hundredweight each, were retained yearly for home consumption.—ED.] It presents itself in commerce in

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[1] *Comm. Götting.* ix. 169.

[2] Graham, *Comp. to Bot. Mag.* ii. 197.

[3] *Ibid.* vol. ii. p. 236.

[4] Murray, *App. Med.* iv. 656.

[5] White, *Voy. to the China Seas*, Boston, 1823, p. 250, quoted by Dr. A. T. Thomson, in *Lond. Disp.*

[6] Murray, *op. cit.* pp. 108 and 657.

[7] Graham, *op. supra cit.* p. 196.

three forms:—1st, *in rolls* or *solid cylinders;* 2dly, *in pipes* or *hollow cylinders;* 3dly, *in cakes* or *amorphous masses.* Both the solid and hollow cylinders are known in commerce as *pipe gamboge.* What is called *coarse gamboge* consists of the commonest pieces of the above.

a. Pipe gamboge consists of cylindrical pieces, varying in size from one to three inches in diameter. Some of them appear to have been formed by rolling; but many of them are striated, from the impression of the bamboo stems into the hollow of which the gamboge juice has been run, and not unfrequently portions of the stems are still adherent; and on one occasion, as above mentioned, the gamboge was imported into the stems (*gamboge in the bamboo*). The gamboge cylinders are sometimes distinct, and covered externally with a dirty greenish-yellow dust; at others agglutinated, or even folded, so as to form masses of varying sizes and forms. Pipe gamboge occurs in all qualities,—the finest and the worst specimens of gamboge which I ever saw having this form. *Fine gamboge* is brittle and odourless: it has very little taste at first, but, after some time, it causes a sensation of acridity in the throat. Its fracture is conchoidal; its fractured surface is opaque, reddish yellow, with a glimmering lustre. It is completely dissolved by the successive action of ether and water. Mixed with a sufficient quantity of water, it forms a yellow emulsion, the films of which are excellent microscopic objects for observing the *active molecules* described by Mr. R. Brown.[1] The powder of fine gamboge is bright yellow. The *Edinburgh College* gives the following characters of pure gamboge:—

> "Fracture somewhat conchoidal, smooth, and glistening: a decoction of its powder, cooled, is not rendered green by tincture of iodine, but merely somewhat tawny."

The iodine is employed to prove the absence of starch. *Inferior qualities* of gamboge are harder, more earthy in fracture; the fractured surface is brownish- or greyish-yellow, frequently with black spots, from the presence of foreign bodies which are intermixed. It is not completely dissolved by the successive action of ether and water. Iodine readily detects, in the cooled decoction, starch, by the green colour which it gives rise to.

β. Lump or *Cake Gamboge* occurs in masses of several pounds weight. Its quality is inferior to the finest pipe kind. Internally we observe fragments of wood, twigs, and air-cells. In most of its characters it agrees with the inferior qualities of pipe gamboge, and like this contains starch.

2. **Ceylon or Cingalese Gamboge** (*Cambogia Zeylanica,* Ph. Ed.)—I am unacquainted with this kind of gamboge, which is unknown in English commerce. Dr. Christison says, that, as he has seen it, it "is usually in small irregular fragments, but, as originally collected, is in flattish round masses, as if moulded in shallow bowls, weighing about a pound or upwards; and it appears to be composed of aggregated irregular tears, with interspaces and cavities, which are lined with a dark powdery matter, or with a powder of an earthy appearance. Altogether it seems a very coarse article." It forms, "with great ease, an emulsion nowise inferior

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[1] *Phil. Mag.* for Sept. 1828 and 1829.

in smoothness, and very little, if at all, in liveliness of tint, to that of th very best pipe Gamboge of Siam."

COMPOSITION.— Gamboge was analysed, in 1808, by Braconnot;[1] i 1813, by John;[2] and in 1836, by Dr. Christison.[3]

	Siam Gamboge.						*Ceylon Gamboge.*		
	Cylindrical or Pipe.		Cake or Lump.		Coarse.				
	First.	Second.	First.	Second.	First.	Second.	First.	Second.	Third.
Resin	74·2	71·6	64·3	65·0	61·4	35·0	68·8	71·5	72·9
Soluble gum	21·8	24·0	20·7	19·7	17·2	14·2	20·7	18·8	19·4
Woody fibre	trace.	trace.	4·4	6·2	7·8	19·0	6·8	5·7	4·3
Fecula	—	—	6·2	5·0	7·8	22·0	—	—	—
Moisture ...	4·8	4·8	4·0	4·2	7·2	10·6	4·6	not ascer-tained.	not ascer tained.
Gamboge...	100·8	100·4	99·6	100·1	101·4	100·8	100·9	96·0	96·6

1. GAMBOGIC ACID; *Gambodic Acid*, Johnston; *Resin*, Christison.—Obtained b evaporating to dryness the ethereal tincture of the pure gum-resin. It is brittle, i thin layers of a deep-orange colour, in thicker masses of a cherry-red tint. It is insoluble in water, but soluble in alcohol, and still more so in ether. It communicate an appreciable yellowness to 10,000 times its weight of spirit. It is soluble in th caustic alkalies, forming dark-red solutions (*alkaline gambogiates*), which yield, wit acids, a yellow precipitate (*gambogic acid*); with acetate of lead, a yellow (*gambogiat of lead*); with the salts of iron, a dark-brown (*gambogiate of iron*), and with sulphat of copper, a brown one (*gambogiate of copper*). The composition of gambogic acid according to Johnston,[4] is $C^{40}H^{23}O^{8}$. When heated to about 400° F. it undergoe partial decomposition, a resin soluble in cold alcohol being formed, and another insoluble in that liquid. The constitution of the latter seems to be represented b $C^{40}H^{22}O^{9}$)—In doses of five grains, gambogic acid occasioned profuse watery discharges, without pain or other uneasiness. If the activity of gamboge depended solel on the resin, five, or five and a half, grains of the resin should be equal to seven o gamboge; but, according to Dr. Christison, this is not the case. Hence, either it i not the sole active ingredient, or it becomes somewhat altered in the process for procuring it: the latter supposition is the more probable.

2. GUM (*Arabine?*)—The gum of gamboge is soluble in cold water, like gum arabic

3. STARCH or *Fecula*.—This substance, which is found in common gamboge, i doubtless an adulterating substance.

CHEMICAL CHARACTERISTICS.— Gamboge emulsion becomes transparent and deep red on the addition of potash, forming *gambogiate o potash*. Digested in alcohol or ether, gamboge yields orange-red tinctures (*solutions of gambogic acid*). The ethereal tincture dropped on water yields, on the evaporation of the ether, a thin, bright yellow, opaque film or scum (*gambogic acid*), soluble in caustic potash. The alcoholic tincture dropped into water yields a bright, opaque, yellow emulsion, which becomes clear, deep red, and transparent, on the addition of caustic potash. The gambogiate of potash (obtained by any of the above processes) gives, if the alkali be not in excess, with acids, a yellow precipitate (*gambogic acid*); with acetate of lead, a yellow precipitate (*gambogiate of lead*); with sulphate of copper, brown (*gambogiate of copper*); and with the salts of iron, dark brown (*gambogiate of iron*).

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[1] *Ann. de Chim.* lxviii. 33.

[2] Gmelin, *Hand. de Chem.* ii. 626.

[3] *Companion to the Botanical Magazine*, ii. 233.

[4] *Phil. Trans.* 1839.

The detection of gamboge in pills has become, on some occasions, an important object of medico-legal research.[1] Spurious *extractum colocynthidis compositum*, and the *pill cochiæ* of the shops, sometimes contain gamboge. The mode of detection, in all these cases, is simple:—Digest one portion of the suspected substance in alcohol, and another in ether. Then subject the alcoholic and ethereal tinctures to the tests above mentioned.

In external appearance the resin of *Xanthorræa hastile* is the only substance that could, by a remote possibility, be confounded with gamboge. But the above chemical characters readily distinguish gamboge. They would also prevent the yellow colouring matter of saffron, of turmeric, and of rhubarb, from being confounded with that of gamboge.

PHYSIOLOGICAL EFFECTS. *α. On Animals generally.*—The animals on which the effects of gamboge have been tried, are dogs, horses, oxen, sheep, and rabbits. From his experiments on dogs, Orfila[2] inferred that it is a powerful local irritant: and that when applied to any of the animal tissues, its fatal operation depends, not on its absorption, but on its powerful local action, and on the sympathetic irritation of the nervous system. It appears to be an uncertain and dangerous medicine for herbivorous animals, and is, therefore, never employed by veterinarians. Daubenton states, that two drachms killed a sheep.[3] Two ounces and a half have been found to produce very little effect on a cow; while twice that quantity caused dysentery, which continued seventeen days. On the horse, from six to twelve drachms have merely rendered the stools somewhat softer and more frequent, although shivering, loss of appetite, irregularity of pulse, great anxiety, and other alarming constitutional symptoms, were brought on.[4] On the other hand, Viborg[5] has given an ounce to the horse without any remarkable effect.

β. On Man.—Taken in *small doses*, gamboge promotes the secretions of the alimentary canal and of the kidneys, and causes more frequent and liquid stools than natural. In *larger doses* it occasions nausea, oftentimes vomiting, griping pains of the bowels, watery stools, and increased discharge of urine. When the action is very violent, there is great depression of the vascular system. In *excessive doses* it acts as an acrid poison. A drachm caused horrible vomiting and purging, followed by syncope and death.[6] The deaths which have occurred from the use of enormous quantities of Morison's pills[7] are mainly ascribable to the gamboge contained in these medicines. In these cases the symptoms were, violent vomiting and purging, abdominal pain and tenderness, cold extremities, and sinking pulse. On *post-mortem* examination, inflammation, ulceration, and mortification of the intestines, were found.

Gamboge belongs to the active hydragogues and drastic purgatives.

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[1] *Trial of Joseph Webb, at York Summer Assizes*, 1834, *taken by Mr. Frazer*, Lond. 1834.

[2] *Toxicol. Gén.*

[3] *Mém. de la Soc. Roy. de Méd. de Paris*, t. iv. p. 261.

[4] Moiroud, *Pharm. Vét.* p. 267–8.

[5] Wibmer, *Wirk. der Arzneim. u. Gifte*, ii. 389.

[6] Paullini, *Eph. Nat. Cur.* Dec. i. Ann. viii. p. 139.

[7] See *Lond. Med. Gaz.* vol. xiv. 612 and 759; xvii. 357, 415, and 623; xviii. 75 and 297; and xix. 976.

Its activity is inferior to elaterium and croton oil. In acridity it exceeds jalap, scammony, and even colocynth. In its mode of operation it is allied to, though scarcely so acrid as, euphorbium. It is exceedingly apt to irritate the stomach, and to occasion nausea and vomiting. This arises from its ready solubility in the gastric juices. As this action on the stomach is exceedingly objectionable, we sometimes endeavour to lessen it by conjoining aloes, or some other substance which diminishes the solubility of gamboge in aqueous fluids, and by giving the medicine in the form of pill. Sundelin[1] ascribes to gamboge an especial power of exciting the vascular system (arteries and veins) of the pelvic organs, in virtue of which, he says, it readily gives rise to the hemorrhoidal flux and uterine hemorrhage. Furthermore, he regards it as powerfully irritating and exciting to the abdominal nerves, especially the sacral and pelvic divisions.

USES.—From the foregoing account of the effects of gamboge, it is very evident that it is a remedy well adapted for acting as a stimulus to the abdominal and pelvic viscera, either to rouse them when in a torpid state, or to give them preternatural activity, and thereby to relieve some distant organ, on the principle of counter-irritation. On the other hand, the use of gamboge is highly objectionable when there is an irritable or inflammatory condition of the stomach or bowels, a tendency to abortion, or to uterine hemorrhage, and also when we do not want to promote or increase the hemorrhoidal discharge. The following are some of the cases in which we employ it:—

1. *In constipation,* where an active cathartic of small bulk is required, gamboge is employed. It is, however, not given alone, as the necessary dose would be very apt to create nausea and vomiting. It is, therefore, usually conjoined with other and milder purgatives, the operation of which it increases and quickens, while they, by diminishing its solubility in the juices of the stomach, lessen its tendency to create nausea or vomiting. The *Pilulæ catharticæ compositæ,* Ph. U.S., and the *Pilulæ cambogiæ compositæ,* L.D., may be referred to as preparations in which these objects have been kept in view.

2. *In cerebral affections,* as apoplexy, or a tendency thereto, gamboge, usually associated with other purgatives as above stated, is a highly valuable counter-irritant purgative. By stimulating and rousing the nerves, blood-vessels, and secretory apparatus of the abdomen, it is often calculated to relieve determinations of blood to other parts.

In dropsies gamboge has been employed, on account of its hydragogue operation, where the use of drastic purgatives is indicated. To its efficacy numerous practitioners have borne testimony. It is, however, rarely given alone, but usually in combination with other and milder remedies (as jalap and bitartrate of potash) of the same class. If it be desirable to act also on the kidneys, an alkaline solution of gamboge has been recommended. Gamboge has been thought more especially serviceable in those forms of dropsy connected with hepatic obstruction.

4. *As an anthelmintic.*—Gamboge has been frequently employed as a

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[1] *Heilmittell,* ii. 28, 3te Aufl.

remedy for tape-worm, and not unfrequently with considerable success. Several empirical anthelmintic remedies[1] are said to owe their efficacy to this substance. It is an important constituent of Madame Nouffer's *specific.*

ADMINISTRATION.—On account of its tendency to occasion vomiting and griping, gamboge is usually given in *small doses*, as from one to three or four grains, in the form of pill, and repeated every four or six hours. In this way it may be given with safety and without inconvenience. The full dose of it is said to be from ten to fifteen grains. An alkaline solution of gamboge has been long known on the continent under the name of *tincture of gamboge* (*tinctura gummi guttæ*),[2] and has been employed as a powerful diuretic in dropsy. It consists of gamboge, in powder, ℥ss.; carbonate of potash, ℥j. (intimately mixed with the gamboge); and brandy, ℥xij. Digest with a gentle heat for four days. —Dose, fʒss. to fʒj.

ANTIDOTE.—In poisoning by gamboge our chief reliance must be placed on the palliatives already mentioned for poisoning by euphorbium and elaterium. I am acquainted with no well-ascertained antidote, though the alkalies (carbonate of potash, according to Hahnemann[3]) have been said to diminish the violence of the topical action of gamboge.

PILULÆ CAMBOGIÆ COMPOSITÆ, L.; *Pilulæ Cambogiæ*, E.; *Gamboge Pills.*—(Gamboge, bruised, ʒij. [*one part, E.*]; Socotrine or Hepatic Aloes, bruised, ʒiij. [East Indian or Barbadoes Aloes, *one part, E.*]; Ginger, bruised, ʒj. [Aromatic powder, *one part, E.*]; Soft Soap, ℥ss. [Castile Soap, *two parts, E.*] Mix the powders together, then add the soap [and then a sufficiency of syrup, *E.*], and beat them into one mass). —Cathartic; considerably more active than the *Pilulæ Aloës compositæ.* Employed in obstinate constipation.—Dose, grs. x. to xv.—The aloes, by diminishing the solubility of the gamboge, renders the latter less likely to irritate the stomach. The formula is said to be a simplification of one proposed by Dr. George Fordyce.

324. CANELLA ALBA, *Murray, L. E. D.*—LAUREL-LEAVED CANELLA, OR WILD CINNAMON.

Sex. Syst. Dodecandria Monogynia.
(Cortex, *L.*—Bark, *E. D.*)

HISTORY.—The bark of this tree has been frequently confounded with that of *Drimys Winteri*, hereafter to be described. Clusius[4] describes both barks, and notices two kinds of canella bark.

BOTANY. **Gen. Char.**—*Sepals* 5. *Petals* 5; somewhat coriaceous, glaucous-blue, contorted in æstivation. *Stamens* united to form a tube; *anthers* 15, resembling furrows. *Stigmas* 3. *Berry* 3-celled, or by abortion 1-celled; cells 1- or 2-seeded. *Embryo* (according to Gaertner, but perhaps an error) surrounded by fleshy albumen, curved, with linear cotyledons (De Cand.)

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[1] See Murray, *App. Med.* iv. 121, et seq.
[2] In Voigtel's *Arzneim.* Bd. ii. Abt. ii. S. 203.
[3] *Hufeland's Journ.* Bd. v. S. 12.
[4] *Exot.* lib. iv. cap. i. p. 75, and cap. iii. p. 78.

Sp. Char.—The only species.

A *tree*, growing from 10 to 50 feet high. *Leaves* alternate, shining, obovate, cuneate at the base, coriaceous and opaque when old, dotted when young. *Flowers* small, clustered, purple. *Berry* the size of a pea, fleshy, smooth, blue or black.[1]

Hab.—West Indies and continent of America.

DESCRIPTION.—The canella bark of the shops (*cortex canellæ albæ*), sometimes termed on the continent *costus dulcis*, or *costus corticosus*, is the inner bark of the stem and branches. It occurs in quills or broken pieces, which are hard, somewhat twisted, of a yellowish-white or pale orange-colour, somewhat lighter on the internal surface, and have an aromatic clove-like odour, an acrid peppery taste, and a white granular fracture.

J. Bauhin and others have confounded it with *Winter's bark;* hence it has been denominated *spurious Winter's bark* (*cortex Winteranus spurius*). The pale colour of its inner surface is one out of several physical characters by which the two barks may be distinguished. Chemically they may be distinguished by nitrate of baryta and sulphate of iron, both of which cause precipitates in the infusion of Winter's bark, but not in that of canella.[2]

COMPOSITION.—Canella bark was analysed, in 1820, by Henry;[3] and in 1823, by Petroz and Robinet.[4]

Henry's Analysis.	*Petroz and Robinet's Analysis.*
Volatile oil.	Volatile oil.
Aromatic resin.	Resin.
Brownish yellow colouring matter.	Bitter extractive.
Extractive.	*Canellin.*
Gum.	Gum.
Starch.	Starch.
Albumen.	Albumen.
Lignin.	Lignin.
Salts.	Salts.
Canella Bark.	Canella Bark.

1. VOLATILE OIL OF CANELLA BARK.—According to Cartheuser it is dark yellow, fluid, and heavier than water. It has an acrid taste.

2. RESIN.—Henry found this constituent to be aromatic, but not acrid.

3. BITTER EXTRACTIVE.—Brown, very bitter, not crystallisable. Soluble in alcohol, ether, and slightly in water.

4. CANELLIN (*Mannite?*)—A crystallisable, saccharine substance, incapable of undergoing the vinous fermentation.

PHYSIOLOGICAL EFFECTS.—Canella bark is an aromatic stimulant and tonic. Its aromatic qualities depend on the oil and resin; its tonic properties on its bitter principle. As an aromatic it ranks between cinnamon and cloves.

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[1] Swartz, *Trans. Linn. Soc.* i. 96.

[2] *Journ. de Pharm.* t. v. p. 481.

[3] *Ibid.*

[4] *Op. cit.* vol. viii. p. 197.

USES.—In this country it is employed principally as an aromatic addition to purgatives and tonics, as *Vinum aloës*, and *Tinctura gentianæ composita*, E., and *Vinum gentianæ*, E.; and is well adapted for debilitated conditions of the digestive organs. [The *Pulvis aloës cum canella*, of former Pharmacopœias (P. L. 1746), was, and still is, a very favourite popular remedy, under the name of *Hiera Picra.*—ED.]

By the Caribs (the ancient natives of the Antilles) and the negroes of the West Indies it is employed as a condiment. It has been considered useful in scurvy.

ADMINISTRATION.—Dose of the powder, grs. x. to ʒss.

VINUM GENTIANÆ, E.; *Wine of Gentian.*—(Gentian, in coarse powder, ℥ss.; Yellow Bark, in coarse powder, ℥j.; Bitter Orange-peel, dried and sliced, ʒij.; Canella, in coarse powder, ʒj.; Proof Spirit, f℥ivss.; Sherry, Oj. and f℥xvj. Digest the root and barks for twenty-four hours in the spirit; add the wine, and digest for seven days more; strain and express the residuum strongly, and filter the liquors.)—Wine of gentian is an aromatic tonic, useful in dyspepsia and anorexia. It is apt to become acetous by keeping.—The dose of it is f℥ss. to f℥j.

ORDER LXXIII. AURANTIACEÆ, *Corréa.*—THE ORANGE TRIBE.

CHARACTERS.—*Calyx* urceolate or campanulate, somewhat adhering to the disk, short, 3- or 5-toothed, withering. *Petals* 3 to 5, broad at the base, sometimes distinct, sometimes slightly combined, inserted upon the outside of a hypogynous disk, slightly imbricated at the edges. *Stamens* equal in number to the petals, or twice as many, or some multiple of their number, inserted upon a hypogynous disk; *filaments* flattened at the base, sometimes distinct, sometimes combined in one or several parcels; *anthers* terminal, innate. *Ovary* many-celled; *style* 1, taper; *stigma* slightly divided, thickish. *Fruit* pulpy, many-celled, with a leathery rind, replete with receptacles of volatile oil, and sometimes separable from the cells; *cells* often filled with pulp. *Seeds* attached to the axis, sometimes numerous, sometimes solitary, usually pendulous, occasionally containing more embryos than one; *raphe* and *chalaza* usually very distinctly marked; *embryo* straight; *cotyledons* thick, fleshy; *plumule* conspicuous.—*Trees* or *shrubs*, almost always smooth, and filled every where with little transparent receptacles of volatile oil. *Leaves* alternate, often compound, always articulated with the petiole, which is frequently winged. *Spines*, if present, axillary (Lindley).

PROPERTIES.—In the bark, leaves, flowers, and rind of the fruit, are numerous vesicular or rounded reservoirs, which contain a highly fragrant volatile oil. Pulp of the fruit acidulous and refrigerant.

325. CITRUS MEDICA, *Risso, E.*[1]—THE CITRON TREE.

Sex. Syst. Polyadelphia Polyandria.

HISTORY.—The fruit of this species is supposed to be the μῆλον μηδικὸν of Theophrastus.[2] Pliny[3] calls it *malum citreum.* It is probable the citron is referred to in the Old Testament on several occasions,[1] where, in our translation, the word apple has been employed.[2]

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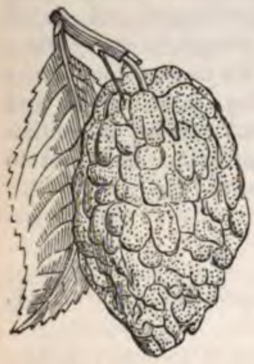
[1] In the Edinburgh Pharmacopœia of 1839, and also in that of 1841, *Lemons* are referred to *Citrus medica*, Risso (De Cand.). This is an error.

[2] *Hist. Plant.* i. 22, and iv. 4.

[3] *Hist. Nat.* xv. 14, ed. Valp.

BOTANY. **Gen. Char.**—*Flowers* usually with a quinary proportion of parts. *Calyx* urceolate, 3- to 5-cleft. *Petals* 5 to 8. *Stamens* 20 to 60; *filaments* compressed, more or less united at the base, polyadelphous; *anthers* oblong. *Style* terete; *stigma* hemispherical. *Fruit* baccate, 7- to 12-celled; cells many-seeded, pulpy. *Spermoderms* (seed coats) membranous; auricles of the *cotyledons* very short (De Cand).—*Trees* or *shrubs*, with axillary spines. *Leaves* reduced to one terminal leaflet at the apex of the petiole, often winged. The *rind* of the fruit is regarded by De Candolle as a kind of torus, by Dr. Lindley as the union of the epicarp and sarcocarp. In the external yellow portion (*flavedo* or *zeste*) of it are the rounded or vesicular receptacles containing volatile oil; the inner white portion is spongy. The *cells* of the fruit are filled with small pulpy bags, readily separable from each other, and containing the acid juice. *Seeds* ex-albuminous, marked externally with the raphe; inner coat stained at one extremity, indicating the place of the chalaza.

FIG. 90.



Citrus medica.

Sp. Char.—*Petioles* naked. *Leaves* oblong, acute. *Flowers* with 40 anthers, often without pistils. *Fruit* oblong, rugous, with a thick rind and aciduous pulp (De Cand.)—*Tree*. Young *branches* violet. *Leaves* subserrate. *Petals* externally purplish. *Fruit* large, violet-red when young, fine yellow when mature; its rind adherent, with an agreeable odour. Risso[3] enumerates three varieties.

Hab.—A native of Asia. Cultivated in the South of Europe.

DESCRIPTION.—The fruit of this tree is the *citron* (*maleum citreum*). It sometimes attains a weight of more than 20 lbs. Those fruits which preserve their pistilla are called *pitima*. Risso says they are sought after by the Jews, who suspend them to palms at the Feast of the Tabernacle. The flavedo of the citron abounds in volatile oil, which may be obtained either by expression or distillation. The leaves, as also the flowers, of the citron-tree, yield a volatile oil by distillation.[4] The leaves are interposed between linen, to which they communicate a fragrant odour: moreover they are said to keep away insects.

Two volatile oils, known respectively as the *essence* or *essential oil of citron*, and the *essence* or *essential oil of cedra*, are employed in perfumery. Both are highly fragrant, almost colourless and lighter than water. They are distinguished by their odour: that of the essence of cedra combining the odours of citron and bergamot. These two oils are usually confounded by pharmacological writers. From their apparent freedom from mucilage I presume both have been procured from distillation. The composition of one of these has been ascertained by Dumas,[5] to be identical with that of the essential oil of lemons, viz. $C^{10}H^{8}$.

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[1] *Cant.* ii., vii., and viii.; *Joel*, 1.

[2] Carpenter, *Script. Nat. Hist.*

[3] *Ann. du Mus. d'Hist. Nat.* xx.

[4] Raybaud, *Journ. de Pharm.* Août, 1834, p. 437.

[5] *Traité de Chimie*, v. 672.

PHYSIOLOGICAL EFFECTS AND USES.—Analogous to those of the orange and lemon. The fruit is seldom brought to the table in the raw state, but it yields some excellent preserves and sweetmeats. The juice is employed to flavour punch and negus. It forms, with sugar and water, a refreshing refrigerant beverage. The essential oil is used in perfumery, and may be employed in medicine for scenting.

326. CITRUS BERGAMIA, *Risso.*—THE BERGAMOT CITRUS.

Citrus limetta, *E.*
Sex. Syst. Polyadelphia Polyandria.
(Volatile oil of the rind of the fruit, *E.*)

BOTANY. **Gen. Char.**—See *Citrus medica.*

Sp. Char.—*Leaves* oblong, more or less elongated, acute or obtuse, under-side somewhat pale. *Petiole* more or less winged or margined. *Flowers* usually small, white. *Fruit* pale yellow, pyriform or depressed; rind with concave receptacles of oil; pulp more or less acid (Wight and Arnott).

Hab.—Cultivated in the South of Europe.

DESCRIPTION.—The *volatile oil* or *essence of bergamot* (*oleum bergamii, oleum bergamotæ*), imported from the South of Europe, is procured from the rind of the fruit. It may be obtained either by expression (as the volatile oil of lemons) or by distillation.[1] It is pale greenish yellow, with a remarkable odour, and a sp. gr. of 0·885. Its composition is identical with that of oil of lemons, being $C^{10}H^{8}$.

USES.—Oil of bergamot is employed as a perfume only. It is a useful odoriferous adjunct to unguents.

327. CITRUS LIMONUM, *Risso, L. E. D.*[2]—THE LEMON TREE.

(Fructûs cortex exterior; Oleum volatile è fructûs cortice expressum; Succus recens et exsiccatus, *L.*—Fruit; Rind of the fruit; Volatile oil of the rind of the fruit, *E.*—Fructus succus, tunica exterior et ejus oleum volatile, *D.*)

HISTORY.—It is supposed that the Greeks and Romans were unacquainted with the orange and lemon, which only became known to Europeans at the time of the Crusades.[3] This supposition receives confirmation from the fact, "that the Persian and Arabian authors do not, as is their wont, give any Greek synonyme of either, but of the citron, which is supposed to have been known to the Romans."[4]

BOTANY. **Gen. Char.**—See *Citrus medica.*

Sp. Char.—Young *branches* flexible. *Leaves* oval or oblong, usually toothed. *Petiole* simply margined. *Flowers* white, tinged with red.

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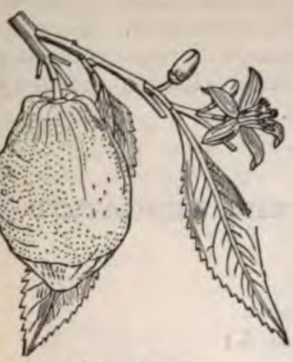
[1] Raybaud, *Journ. de Pharm.* Août 1834.

[2] In the Edinburgh Pharmacopœia limes are erroneously referred to this species.

[3] Macfadyn, in Hooker's *Bot. Miscel.* vol. i. p. 299.

[4] Royle, *Illustr.* p. 130.

Fig. 91.



Citrus Limonum.

Fruit yellow, ovoid or rarely globular; terminated by a more or less elongated knob; rind with convex vesicles of oil; pulp acid (Wight and Arnott).

Hab.—A native of Asia (Himalaya, *Royle*; Persia *Risso*). Cultivated in the South of Europe.

Description, Composition, Properties, and Uses.—Lemons (*limones*) are imported from Spain, Portugal, Italy, and the Azores, packed in chests, each lemon being separately rolled in paper. The Spanish lemons are most esteemed. We employ in medicine both *the rind* and *the juice*.

1. **Lemon Peel** (*Cortex Limonum*, L. E. D.)—The flavedo (*flavedo corticis limonum*) is pale yellow and rough. By drying, its colour deepens. Its taste is aromatic and bitter; its odour, which is owing to the volatile oil lodged in appropriate receptacles, is strong and peculiar. The inner portion of the cortex is white, spongy, and almost both odourless and tasteless. The flavedo yields, both by distillation and expression, a volatile oil (*essential oil of lemons*). A watery infusion of lemon peel becomes greenish-brown on the addition of the sesquichloride of iron.

Lemon peel has not been regularly analysed, though some of its constituents have been examined. It contains *volatile oil, hesperidin, a bitter principle,* and *gallic acid.*

1. Volatile Oil.—(See p. 538.)

2. Hesperidin.—A crystallisable, neutral, resinous (?) principle, which resides in the white portion of the rind of the fruit of the genus *Citrus*. It has the form of silky needles, which are odourless and tasteless, when pure, though they usually possess slight bitterness, probably from the presence of another principle. It is fusible, slightly soluble in water, but more so in alcohol; insoluble in ether, and the oils both fixed and volatile. Oil of vitriol reddens it.[1]

3. Bitter Matter (*Aurantiin*).—This is referred to the class of substances vaguely denominated extractive. It is the presence of this substance which enables an aqueous solution of impure hesperidin to form a reddish-brown precipitate with the persalts of iron. It frequently contains traces of gallic acid.

Lemon peel is a grateful stomachic and aromatic. It is employed more as a flavouring ingredient than for its own proper effects. It is a constituent of the *Infusum Gentianæ compositum*, and of the *Infusum aurantii compositum*. *Candied Lemon peel* (*cortex limonum conditus*) is an agreeable stomachic, and is employed as a dessert and in confectionary.

1. **SUCCUS LIMONUM**, L.; *Lemon Juice*.—A slightly turbid, very sour liquor, with a grateful flavour, obtained from lemons by expression and straining. Owing to the mucilage and extractive which it contains, it readily undergoes decomposition, though various methods have been proposed of preserving it. On this account an *artificial lemon juice* has been proposed as a substitute. The juice both of lemons and limes (the

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[1] Hebreton, *Journ. de Pharm.* xiv. 377.

fruit of *Citrus Lima*, Macfadyen, or *C. acida*, Roxburgh) is extensively imported. In 1839, duty of one halfpenny per gallon was paid on 37,338 gallons of these juices. In the West Indies *lime juice* is preferred to lemon juice.

According to Proust, *lemon juice* consists of *citric acid*, 1·77; *malic acid*, *gum*, and *bitter extractive*, 0·72; and *water*, 97·51. *Lime juice* contains the same ingredients, in somewhat different proportions: the quantity of citric acid in it is larger, while that of mucilage, &c. is less.

CITRIC ACID. — (See *post*, p. 540.)

Lemon juice furnishes a most agreeable and refreshing beverage, and proves refrigerant and antiscorbutic. It is employed for several purposes, as follows:

a. In the preparation of refrigerant drinks.—It may be either added to barley-water, or mixed with sugar and water to form *lemonade*. The latter may be extemporaneously made, by adding two lemons sliced, and two ounces of sugar, to two pints of boiling water, and digesting until cold. A similar beverage is called, by Mr. Brande,[1] *King's Cup*. These acidulated drinks are exceedingly useful for allaying thirst, and as refrigerants in febrile and inflammatory complaints, and in hemorrhages. In the latter maladies *iced lemonade* should be preferred. Where there is nausea or a tendency to sickness, *effervescent lemonade* is useful. "Lemonade, as a beverage in putrid diseases, was first introduced by the French physicians in the beginning of the seventeenth century; and about the year 1660, an Italian from Florence having learned a process of freezing confectionary, conceived the happy idea of converting such beverage into ice. This found a ready sale, and was the occasion of so great an increase in the number of sellers of lemonade, that in the year 1660, the *Lemonadiers* of Paris were formed into a company, and received a patent from the Government."[2]

β. In the formation of the effervescing draught.—The effervescing draught, made with lemon juice (or citric acid) and bicarbonate of potash, is one of the best remedies we possess for allaying sickness and vomiting. The citrate of potash, which is formed, is a mild diaphoretic and diuretic, and often allays restlessness and watchfulness in fever. It is adapted for lithic acid deposits; but, like other remedies of the same class, is sometimes objectionable in phosphatic deposits. When our object is to determine to the skin, an effervescing draught, composed of lemon juice or citric acid and sesquicarbonate of ammonia, is to be preferred. The relative proportions of the alkaline carbonates, and of lemon juice or citric acid, for the formation of effervescing draughts, is as follows:—

Citric Acid.		*Lemon Juice.*		*A Scruple of the Alkali.*
Grains 14	or	fʒiiiss.	....	Bicarbonate of Potash.
Grains 17	or	fʒiv.	....	Carbonate of Potash.
Grains 24	or	fʒvj.	....	Sesquicarbonate of Ammonia.

Effervescing draughts are exceedingly valuable vehicles for the exhibition of other remedies.

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[1] *Dict. of Pharm.* 341.

[2] Dr. Paris, *Pharmacol.* 6th edit. ii. 301.

γ. *As an Antiscorbutic.*—Lemon juice has long been regarded as an invaluable antiscorbutic; but on account of the difficulty of preserving it, crystallised citric acid is usually substituted. "Those only," says Sir Gilbert Blane,[1] "who have made themselves acquainted with the early part of the naval history of this country, or those who have perused the interesting, popular, and eloquent narrative of Commodore Anson's voyage, can duly appreciate the value of this simple remedy." Yet, on hypothetical grounds, Dr. Stevens[2] ventures to assert that citric acid produces scurvy!

δ. *As an Antidote.*—In poisoning by the alkalies and their carbonates, the vegetable acids are the antidotes; and the most convenient, easily procurable acidulous substances are, in general, vinegar and lemon juice.

ε. *As an Anti-narcotic.*—In poisoning by narcotic substances, as opium, lemon juice may be administered, after the poison has been removed from the stomach, to counteract the effects.

[*In Rheumatism.*—Lemon juice has been recommended as a remedy in acute rheumatism and gout by Dr. Owen Rees, and has been used with success by many practitioners, not only in this country, but in Italy, France, and America. Dr. Rees considers the citric acid to undergo changes in the stomach, and to supply oxygen to such elements as tend to produce uric acid, and thereby to induce the formation of urea and carbonic acid instead.—ED.]

ζ. *Other uses.*—Several of the medicinal uses of lemon juice can only receive a passing notice. Such are, the employment of it, with common salt, in *dysentery, remittent fever, bellyache,* and *putrid sore-throat,* as recommended by Dr. Wright;[3] its use in *cardialgia,* by Dr. Dewees; and in *syphilis,* by Dr. Rollo. *As a topical remedy for uterine hemorrhage* after delivery, Dr. Evratt[4] recommends that a cut peeled lemon be introduced into the uterus, and the juice there expressed. It causes uterine contractions, by which the juice is expelled, and the hemorrhage stopped. In *hospital gangrene,* Dr. Werneck[5] applied, with good effect, in the first stage of the disease, either lint soaked in lemon juice, or segments of lemons.

ADMINISTRATION.—The mode of employing lemons will be obvious from the preceding remarks.

1. OLEUM LIMONUM, L. E. D.; *Essential Oil of Lemon Peel; Essence of Lemons.*—This oil is usually procured by expression, as follows:—The flavedo of the lemons is removed by rasping, and is afterwards expressed in hair sacks. The oil which is thus procured is received in flasks, where it deposits some of its impurities, and is then decanted and filtered.[6] Baumé[7] says the rasped flavedo is pressed between glass plates. Expressed oil of lemons is somewhat turbid, and liable to undergo change by keeping, owing to the mucilaginous matter which it contains in solution. Oil of lemons may be procured also by distillation; and the oil thus procured is pure, not disposed to undergo change by keeping, and is employed, under the name of *scouring drops*, for removing grease spots from silks and other textures; but its flavour is less pleasant and sweet. The greater part of the oil of commerce is brought from Portugal and Italy; some, however, is procured from France. When quite pure, it is colourless, limpid, and of a fragrant odour, like that of lemons. Its sp. gr. at 70° F. is 0·847. It is soluble in all proportions in anhydrous alcohol, but less soluble in rectified spirit, and it boils at about 140° F. When the commercial oil is exposed to a temperature of −4° F. it deposits white crystals, the nature of which is not known: the rectified oil remains perfectly liquid and transparent at this temperature. Oil of lemons is composed of two isomeric oils,—one (*citrene*, Dumas; *citronyle*, Blanchet and Sell) capable of forming, with hydrochloric acid, a crystalline compound (composed of $C^{10}H^{8} + HCl$); the other (*citryle*) not forming any crystalline compound with this acid. The composition of the oil of lemons is $C^{10}H^{8}$ [or $C^{5}H^{4}$, according to Gregory] *i. e.* it is polymeric with the oils of turpentine, savin, copaiva, juniper, bergamot, and citron.[1]

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[1] *Select Dissert.* p. 8, 1822; see also *Observ. on the Diseases incident to Seamen.*

[2] *On the Blood.*

[3] *Memoir of the late Dr. Wright,* p. 322.

[4] *Arch. Gén. de Méd.* Janv. 1825, p. 141.

[5] Dierbach, *Neuest. Entd. in d. Mat. Med.* 2te Abt. S. 512, 1828.

[6] Henry and Guibourt, *Pharm. Raison.* 2ème édit. t. i. p. 284.

[7] *Elém. de Pharm.* t. i. p. 486.

Oil or essence of lemons possesses the stimulant properties of the milder volatile oils, and is denominated carminative and diaphoretic. In full doses it is said to be apt to occasion headache and giddiness. Its principal use is for communicating an agreeable odour and flavour to other medicines. It may be taken as a carminative, in the dose of a few drops, on sugar (*elæosaccharum limonum*). As a perfume, it is an exceedingly useful adjunct to sulphur ointment, and to evaporating lotions. To this, as to some other volatile oils (see *oleum rosmarini*), has been ascribed the power of promoting the growth of the hair, and, in consequence, it has been added to pomatum. More recently it has been employed as a stimulant application in various external inflammations of the eye. It was first used in these diseases by Dr. Worlitz,[2] who applied it by squeezing the little drops of oil from the rind of the lemon into the eye. He used it with good effect in rheumatic, catarrhal, and scrofulous inflammations of the eye, in pannus and pterygium, and in opacity and some other consequences of inflammation of the cornea. It has since been tried by Mr. Foote,[3] at the Ophthalmic Hospital, who dropped the oil into the eye in the same way that the *vinum opii* is applied. In some cases it causes excessive pain. He thinks it preferable to the *vinum opii* in all cases where a stimulant is required.

2. **SYRUPUS LIMONUM,** L. E.; *Syrup of Lemons.* (Lemon juice strained [and freed from impurities by subsidence, *E.*], Oj.; Sugar, lbs. iiss. [Rectified Spirit, ℥iiss. *L.*] [Boil the juice for ten minutes, and strain; add the sugar to this, and dissolve. Lastly, when the syrup is cold, add the spirit.—The *Edinburgh College* dissolves the sugar in

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[1] For some interesting observations on this and some other oils of this order, see Soubeiran and Capitaine, *Journ. de Pharm.* xxvi. 1 and 66.

[2] Dierbach, *Neuest. Entd. in d. Mat. Med.* Bd. i. S. 78, 1837; also *Lond. Med. and Phys. Journ.* for 1830, new series, vol. viii. p. 366.

[3] *Trans. of the Med.-Bot. Soc.* for 1832–3, p. 73.

the juice, allows subsidence, skims, and pours off the clear liquor. The *Dublin College* has now a substitute for this syrup, which is called *Syrupus Acidi Citrici,* made as follows:—Citric Acid in powder, Distilled Water, of each ℥iiss.; Tincture of Lemon Peel, ʒv.; Simple Syrup, Oiij. The acid is dissolved in the water, and the solution added to the syrup and tincture.—ED.] Refrigerant. An agreeable adjunct to diluent drinks, as barley-water, in febrile and inflammatory complaints, and to gargles.—Dose, fʒj. to fʒiv.

328. ACIDUM CITRICUM, *L. E. D.*—CITRIC ACID.

HISTORY.—This acid was first procured in the solid state by Scheele in 1781. It is sometimes termed the *Concrete Acid of Lemons.*

NATURAL HISTORY.—Citric acid is peculiar to the vegetable kingdom. It is found in many acid juices of fruits usually free, but sometimes in combination with either potash or lime. Besides the fruits of the genus *Citrus,* it is found, with little or no malic acid, in the fruits of Dulcamara, Dog-rose, Cranberry, Bird-cherry, and Whortleberry. Mixed with an equal quantity of malic acid, it is found in the Gooseberry, Red Currant, Strawberry, Raspberry, and Cherry. In the Tamarind it exists with both malic and tartaric acids.

PREPARATION.—The Edinburgh College alone gives directions for the preparation of this acid.

The *London College*, in its former Pharmacopœia, ordered of Lemon Juice, Oiv.; Prepared Chalk, ℥ivss.; Diluted Sulphuric Acid, ℥xxviiss.; Distilled Water, Oij. Add the Chalk gradually to the Lemon Juice made hot, and mix. Set by, that the powder may subside: afterwards pour off the supernatant liquor. Wash the Citrate of Lime frequently with warm water. Then pour upon it the diluted Sulphuric Acid and the distilled Water, and boil for a quarter of an hour. Press the liquor strongly through linen, and strain it; evaporate the strained liquor with a gentle heat, and set it by, that crystals may be formed. Dissolve the crystals, that they may be pure, again and a third time in water, and as often strain the solution, boil down, and set it aside.

The *Edinburgh College* employs the same quantity of Lemon Juice and Chalk (or of the latter a sufficiency), and "Diluted Sulphuric Acid, f℥xxvii., or in the same proportion to the chalk required."[1] The lemon juice is to be boiled twice, and allowed to rest once before the chalk is added. After the sulphuric acid has been added, the filtered liquor is to be tested with a solution of nitrate of baryta, and if the precipitate thereby obtained be not almost "entirely soluble in nitric acid," more citrate of lime is to be added [to saturate the great excess of sulphuric acid.]

The *Dublin College* gives no process for the preparation of this acid.

The juice of lemons and limes is imported for citric acid manufacturers, in pipes and hogsheads. It is saturated with chalk or whiting in a large vat. By this means a citrate of lime is formed. This is precipitated, while the carbonic acid of the chalk escapes, and the mucilage of the juice for the most part remains in solution.

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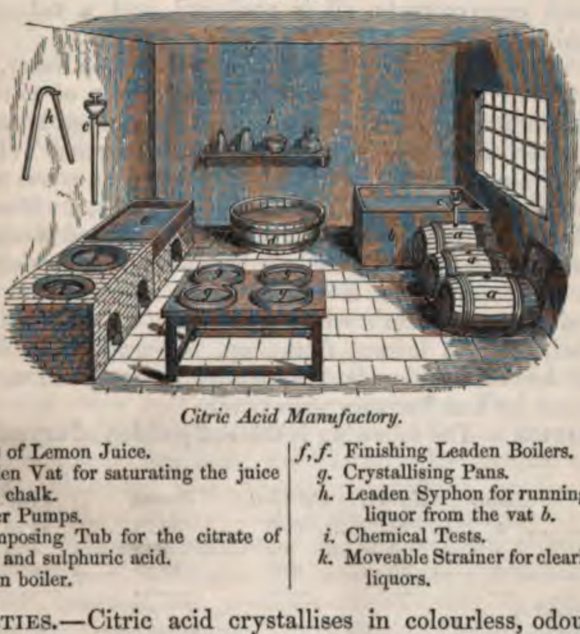
[1] The Edinburgh College employs half an ounce of diluted sulphuric acid less than the quantity formerly ordered by the London College; whereas it ought to have been increased by eight ounces, in consequence of the diluted sulphuric acid of the Edinburgh Pharmacopœia being weaker than that of the London Pharmacopœia (Mr. R. Phillips, *Lond. Med. Gaz.* new series, vol. ii. 1838–9, p. 690).

MATERIALS.	COMPOSITION.	PRODUCTS.
Chalk	*Carbonic Acid*	Carbonic Acid Gas.
	Lime	
Lemon Juice	*Water, Mucilage, &c.*	Water, Mucilage, &c.
	Citric Acid	Citrate of Lime.

$$[\bar{\mathrm{Ci}} + \mathrm{CaO,Co^2} = \mathrm{CaO},\bar{\mathrm{Ci}} + \mathrm{CO^2}.]$$

The supernatant liquor is then drawn off, and the citrate of lime is passed through a sieve and frequently washed with warm water, until the mucilage and other soluble impurities are for the most part got rid of. Sulphuric acid, diluted with water, is afterwards added: sulphate of lime separates, and citric acid is left in solution, [$\mathrm{CaO}, \bar{\mathrm{Ci}} + \mathrm{SO^3} = \bar{\mathrm{Ci}} + \mathrm{CaO,SO_3}$.] The clear solution is then evaporated in leaden boilers, and the concentrated solution set aside to crystallise. The crystals are afterwards purified by re-solution, and re-crystallisation.[1]

FIG. 92.

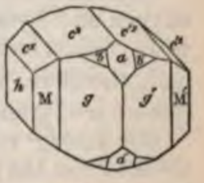


Citric Acid Manufactory.

a, a, a. Casks of Lemon Juice.	*f, f.* Finishing Leaden Boilers.
b. Wooden Vat for saturating the juice with chalk.	*g.* Crystallising Pans.
c, c. Copper Pumps.	*h.* Leaden Syphon for running off the waste liquor from the vat *b*.
d. Decomposing Tub for the citrate of lime and sulphuric acid.	*i.* Chemical Tests.
e. Leaden boiler.	*k.* Moveable Strainer for clearing the mother liquors.

PROPERTIES.—Citric acid crystallises in colourless, odourless, very sour, transparent, short, rhomboidal prisms, whose extremities are terminated by four trapezoidal faces, and which belong to the right prismatic system.[2] Crystallised citric acid becomes damp by exposure to a moist atmosphere, though Dumas and other French chemists state it to be unalterable by the air. According to Vauquelin, it is soluble in 75 parts of cold and 50 of boiling water. The solution is strongly acid, and becomes mouldy by keeping. Crystallised citric acid is much less soluble in alcohol than in water. Its sp. gr. is 1·617. Heated with potash, it is converted into

FIG. 93.



Crystal of Citric Acid.

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[1] For further details, consult Parke's *Chemical Essays*, 2d edit. i. 539, 1823.

[2] Brooke, *Annals of Philosophy*, new series, vi. 119.

oxalic and acetic acids and water. Treated with oil of vitriol it evolves sulphurous acid, carbonic acid, carbonic oxide, acetic acid, and water. Heated with nitric acid, it becomes oxalic acid.

According to Crasso, crystallised citric acid, when exposed to heat, exhibits four stages of decomposition. During the first, the water of crystallisation alone is given off, and the residue contains unaltered citric acid. The second stage is characterised by white vapours, and the production of acetone, carbonic oxide, and carbonic acid, while the residue consists of hydrated aconitic acid ($C^4HO^3 + Aq.$), which is the true pyrocitric acid. In the third stage, the aconitic acid, not being volatile, is itself decomposed, yielding carbonic acid and an oily liquid which soon crystallises. This is the pyroaconitic acid, the citricic of Baup, for which Crasso proposes the name of itaconic acid ($C^5H^2O^3 + HO$). This acid, when heated, yields citraconic acid ($C^5H^2O^3 + HO$), the citricic acid of Baup. In the fourth period empyreumatic oil is produced, and a voluminous coal remains behind.[1]

Characteristics.—When added in excess to lime water, no precipitate is produced. "When a few drops of a solution of citric acid are added to lime water, a clear liquid results, which, when heated, deposits a white powder, soluble in acids without effervescence" (Liebig). It does not yield a crystalline precipitate when added in excess to a solution of carbonate of potash. It forms, with barytic water, a white precipitate (*citrate of baryta*). With a solution of acetate of lead it also furnishes a white precipitate (*citrate of lead*), soluble in ammonia, which forms with it a double salt (*ammoniacal citrate of lead*). Added to a solution of nitrate of silver it produces a white precipitate (*citrate of silver*), which, when heated, becomes brown, froths up, deflagrates, discharges white fumes, and leaves an abundant ash-grey, coarsely fibrous, crumbly residue, which by heat becomes pure silver.

Composition.—The following is the composition of crystallised citric acid:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Dumas.*	*Prout.*	*Ure.*
Carbon	4	24	35·8	36·28	34·28	33·00
Hydrogen	3	3	4·5	4·45	4·76	4·63
Oxygen	5	40	59·7	59·27	60·96	62·37
Citric Acid crystallised by cooling a solution saturated at 212°. ...	1	67	100·0	100·00	100·00	100·00

Crystallised citric acid of commerce contains, however, somewhat more oxygen and hydrogen (elements of water) than the above. According to Berzelius, hypothetical dry citric acid is composed of $C^4H^2O^4(=58)$; and, therefore, the acid, crystallised by cooling, consists of $\overline{Ci} + Aq.$ $(58 + 9 = 67)$, and the commercial acid of $\overline{Ci} + 1\frac{1}{3}Aq.$ $(58 + 12 = 70)$.

But Liebig[2] regards the hypothetical dry citric acid as composed of $C^{12}H^5O^{11}(=165)$. On this supposition, the acid, crystallised by cooling, is composed of $\overline{Ci} + 3HO + Aq.$ $(165 + 36 = 201)$; and the commercial crystals, of $\overline{\text{Ci}}+3\text{HO}+2\text{Aq}$. ($165+45=210$). On this view of its constitution citric acid is a tribasic acid; that is, it combines with three equivalents of base: its equivalent weight being three times the amount assumed in the above tables.

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[1] Crasso, quoted by Liebig, in Turner's *Elements of Chemistry*, 7th edit.

[2] Turner's *Elements of Chemistry*, 7th edit.

PURITY.—Powdered citric acid is sometimes adulterated with powdered tartaric acid. The fraud may be readily detected by dissolving the suspected acid in a small quantity of water, and adding cautiously to it a solution of carbonate of potash, taking care that the acid be in excess. If any tartaric acid be present, a white crystalline precipitate (*bitartrate of potash*) is formed. The directions of the London and Edinburgh Colleges for ascertaining the purity of the acid are as follows:—

> This acid is soluble in water; what is precipitated from the solution by acetate of lead is dissolved by nitric acid. No salt of potash, except the tartrate, is precipitated by solution of citric acid. It is totally dissipated in the fire (*Ph. Lond.*)

The solubility of the plumbeous precipitate in nitric acid shows the absence of sulphuric acid or a sulphate, although a salt of baryta would be a better test.

> A solution in four parts of water is not precipitated by carbonate of potash: when incinerated with the aid of the red oxide of mercury, no ash is left, or a mere trace (*Ph. Ed.*)

The elements of citric acid (viz. oxygen, hydrogen, and carbon) are dissipated by a red heat. But this dissipation is promoted by agents (*ex* red oxide of mercury) capable of supplying oxygen without leaving any fixed residuum. [When the acid is slowly heated in air it melts, burns with a yellowish flame, and leaves but a small residue of carbon. When warmed with concentrated sulphuric acid it is not blackened like tartaric acid, but acquires a yellowish colour. The presence of tartaric acid when mixed with citric acid may thus be detected.—ED.]

PHYSIOLOGICAL EFFECTS.—Orfila[1] ranks citric acid among the irritant poisons; but Drs. Christison[2] and Coindet gave drachm doses of it to cats without observing that the animals suffered any inconvenience therefrom. The effects of large doses of this acid on man I am not acquainted with. Small quantities of it, dissolved in water, form an agreeable beverage, which allays thirst, diminishes preternatural heat, checks profuse sweating, and promotes the secretion of urine. Vogt[3] considers it to act more powerfully on the skin, and less so on the alimentary canal and urinary organs, than tartaric acid. In its action on the skin it agrees with acetic acid. The continued employment of it, as well as of other acids, disturbs the functions of the digestive organs.[4]

USES.—Citric acid is employed in medicine, as a substitute for lemon juice, in the preparation of refrigerant drinks and effervescing draughts, and as antiscorbutic, anti-narcotic, and anti-alkaline. (See *Lemon Juice.*)

1. ARTIFICIAL LEMON JUICE.—This is prepared by dissolving Citric Acid, ʒviiiss., in Water, f℥xvj., and flavouring with a few drops of

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[1] *Toxicologie Générale.*

[2] Christison, *On Poisons*, 3d edit. p. 208.

[3] *Pharmakodyn*, ii. 72, 2te Aufl.

[4] For some additional observations on its effects, see the article *Lemon Juice*, ante, p. 537.

Essence of Lemons. This is less apt to undergo decomposition than the genuine juice, for which the artificial juice may be employed in the preparation of cooling beverages.

2. EFFERVESCING CITRATES.—Citric acid, with the alkaline carbonates, is frequently employed in the preparation of effervescing draughts. The following are the relative proportions of acid and base required to form a neutral compound.

20 *grains of Commercial Crystals of Citric Acid are saturated by about* —

Crystallised Bicarbonate of Potash	29 grs.
Carbonate of Potash of Commerce	24 "
Hydrated Sesquicarbonate of Ammonia	17 "
Crystallised Carbonate of Soda	41 "
Sesquicarbonate of Soda of Commerce	24 "

The most agreeable effervescing citrate is that prepared with bicarbonate of potash, flavoured with tincture of orange-peel and syrup (see *Potassæ citras*, Vol. I. page 521). The carbonates of soda are rarely employed with citric acid.

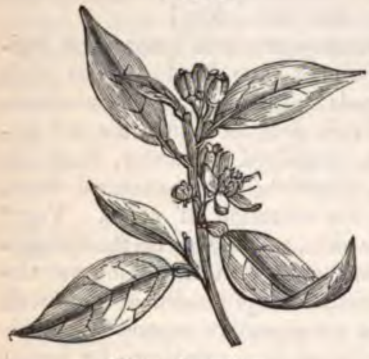
329. CITRUS AURANTIUM, *Risso, L. E. D.*—THE COMMON OR SWEET ORANGE TREE.

Sex. Syst. Polyadelphia Polyandria.

(Fructûs; Fructûs cortex exterior; Flores; Oleum è floribus destillatum, *L.*—Distilled water of the flowers; Volatile oil of the flowers, *E.*—Fructûs succus et tunica exterior; Flores; Folia, *D.*)

HISTORY.—It is somewhat uncertain when the sweet orange became known to Europe. The bitter orange, as well as the lemon, was known during the middle ages, but the sweet orange is supposed not to have been introduced until a period after this.[1]

FIG. 94.



Citrus Aurantium.

BOTANY. **Gen. Char.** — See *Citrus medica.*

Sp. Char. — *Leaves* oval, elongated, acute, sometimes slightly toothed; *petiole* more or less dilated and winged. *Flowers* white, large. *Fruit* orange-coloured, roundish or ovoid, usually depressed, rarely terminated by a small knob; *rind* with convex vesicles of oil; *pulp* sweet (Wight and Arnott)—A great number of sorts is known to gardeners. The *China orange* is the common orange of the markets and of the Portuguese. The *St. Michael's orange* is a small seedless variety. The *blood-red orange* has a reddish yellow fruit, with a pulp irregularly mottled with crimson.

Hab.—Asia; probably China. Cultivated in the South of Europe, the Azores, and the West Indies.

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[1] Macfadyen, *Bot. Miscell.* i. 302.

DESCRIPTION.—*Orange leaves* (*folia aurantii*) are feebly bitter. Their watery infusion is greenish and somewhat bitter. They contain a fragrant volatile oil, which is procured by distillation, and is called, in the shops, *essence de petit grain*. *Orange flowers* (*flores aurantii* seu *naphæ*), when fresh, are white. They are sometimes exported from the South of Europe, stratified with common salt, in barrels (Risso). Dried orange flowers are yellowish, and have an agreeable odour, which is less powerful than that of the fresh flowers. By distillation, orange flowers yield a fragrant volatile oil (*oleum Neroli; oleum aurantii*). *The small green fruits* (*fructus immaturus aurantii*), which fall during the great heats of the summer, are carefully collected and dried. They, as well as the unripe fruit of the next species [*citrus vulgaris*] form the *orange berries* (*baccæ aurantii*) of the shops. Their size does not exceed that of a cherry; their colour is dark greyish or greenish brown; they have an aromatic odour and a bitter taste. They are used for flavouring *Curaçoa*. When smoothed by a lathe, they constitute the *issue peas* of the shops: they are preferred to ordinary peas for keeping up the discharge of an issue, on account of their pleasant odour. An infusion of orange berries is rendered green by the sesquichloride of iron. By distillation, these berries yield a fragrant oil (the original *essence de petit grain*). *The ripe fruit*, or the *orange* (*aurantium; poma aurantiorum*), is imported in chests and boxes, each orange being separately packed in paper. The best come from the Azores and Spain; very good ones are also brought from Portugal, Italy, and other places. The *rind* is sometimes employed as a substitute for the rind of the bitter orange. It yields, by distillation, a fragrant volatile oil (*essential oil of sweet orange*).

COMPOSITION.—1. **Orange Flowers** were analysed by Boullay,[1] and found to contain *volatile oil, bitter extractive, gum, acetic acid,* and *acetate of lime.*

2. **Orange Berries** were analysed, in 1828, by Lebreton,[2] who found their constituents to be as follows:—*Volatile oil, sulphur, chlorophylle, fatty matter, hesperidin, bitter astringent matter,* with some traces of *gallic acid, citric and malic acids, citrates and malates of lime and potash, gum, albumen, lignin, mineral salts,* and traces of *iron* and *silica.* Widemann[3] obtained a *crystalline substance* analogous to, but yet different from, hesperidin.

3. **Orange Peel** has not been analysed; but its composition is, doubtless, analogous to that of lemon peel.

4. **Orange Juice** consists of *citric acid, malic acid, mucilage, albumen, sugar, citrate of lime,* and *water.*

1. VOLATILE OILS FROM THE SWEET ORANGE TREE.—The volatile oils obtained from the leaves, flowers, and fruit rind of the sweet orange tree, agree, in their essential chemical characters, with each other, with the corresponding oils obtained from the bitter orange, and with the volatile oil of lemons. They differ principally in their odour.

The *oil of sweet orange* kept in the perfumers' shops is obtained by distillation with water, from the rind of the fruit.

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[1] *Bull. de Pharm.* i. 337.

[2] *Journ. de Pharm.* xiv. 377.

[3] *Ibid.* xvi. 707.

The other volatile oils of this species are not distinguished in English commerce from those of the next species.

2. HESPERIDIN.

3. BITTER PRINCIPLE (*Aurantiin*). See p. 536.

4. WIDEMANN'S CRYSTALLINE MATTER.—Obtained from unripe oranges. Is distinguished from Hesperidin by its very distinct prismatic crystallisation, by its insolubility in water, and by its not forming oxalic acid with nitric acid.

PHYSIOLOGICAL EFFECTS AND USES.—**Sweet Orange Peel** is an aromatic stimulant and tonic analogous to lemon peel, and is occasionally employed as a substitute for the *bitter orange peel.* "Large quantities of it are sometimes productive of mischief, especially in children, in whom colic, and even convulsions, are sometimes induced by it. We have known the case of a child, in which death resulted from eating the rind of an orange."[1]

Orange Juice is a refreshing and grateful beverage, and is extensively used at the table. In febrile and inflammatory complaints it is a valuable refrigerant;—allaying thirst and diminishing preternatural heat.

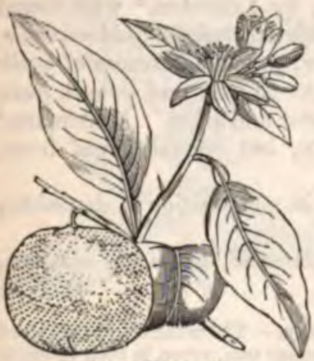
330. CITRUS BIGARADIA, *Risso, L. E. D.*—THE BIGARADE OR BITTER ORANGE TREE.

Sex. Syst. Polyadelphia Polyandria.

(Fructûs cortex exterior, *L.*—Distilled water of the flowers; Rind of the Fruit; Volatile oil of the flowers, *E. D.*)

HISTORY.—The bitter orange became known to Europe during the middle ages. All the old established orange groves of Spain, as those at Seville, planted by the Moors, are of the bitter orange.[2]

FIG. 95.



Citrus Bigaradia.

BOTANY. **Gen. Char.**—See *Citrus medica.*

Sp. Char.—*Leaves* elliptical, acute or acuminated, slightly toothed. *Petiole* more or less winged. *Flowers* large, white. *Fruit* orange-coloured, roundish or slightly elongated or depressed; rind with concave vesicles of oil; pulp acid and bitter (Wight and Arnott).

Numerous varieties of this are cultivated. One of these yields the fruit known in the English market as the *Seville Orange.*

Hab.—Asia. Cultivated in Europe.

DESCRIPTION.—The *leaves* of this species, when rubbed, emit a very agreeable odour. Distilled with water they yield a bitter aromatic water, known in Languedoc as *eau de naphre* (*aqua naphæ*). At the same operation is procured a volatile oil, called the *essence de petit grain*, of finer quality than that obtained from the leaves of the sweet orange. The *flowers* yield, by distillation with water, *orange-flower water* (*aqua aurantii*, Ph. Ed.) and *oil of Neroli* (*oleum*

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[1] *United States Dispensatory.*

[2] Macfadyen, in Hooker's *Bot. Miscell.* i. 302.

aurantii, Ph. Ed.) of finer quality than the corresponding preparations obtained from the flowers of the sweet orange. The *unripe fruits*, like those of the sweet orange, are called *orange berries*, and are employed for the purposes before mentioned. The *Seville orange* is round and dark, and has an uneven, rugged, very bitter rind (*bitter orange peel; cortex aurantii*, Ph. L. and Ed.), which is employed for medical purposes as well as in the preparation of *candied orange peel*, and for flavouring the liqueur called *Curaçoa*.

COMPOSITION.—The composition of the *leaves*, *flowers*, and *fruit* of the bitter orange is doubtless analogous to that of the corresponding parts of the sweet orange.

1. OIL OF ORANGE-LEAF; *Essence de petit grain.*—The term *essence de petit grain* was originally applied to the volatile oil of the orange berry, which, however, readily underwent decomposition. It is now used to indicate the volatile oil obtained from the leaves both of the bitter and sweet orange. That procured from the bitter orange is of better quality than that from the sweet.

2. OIL OF ORANGE-FLOWER; *Oil of Neroli (Oleum Aurantii).*—Procured from the flowers of both the bitter and sweet orange; but that from the former is preferred. It is obtained by submitting the flowers, with water, to distillation; and it is found floating on the water in the receiver. It has an aromatic and fragrant odour, somewhat different from that of the flower. "It appears to me," says Soubeiran,[1] "to be a product of the alteration of the natural essential oil. The latter is more soluble than the neroli oil, and remains in solution in the water. Its presence may be demonstrated by agitating the distilled water with ether deprived of alcohol. By spontaneous evaporation the ethereal solution leaves behind an essential oil, which has absolutely the same odour as the flowers, and which dissolves in water." Oil of neroli, furnished me by one of the most respectable importers as genuine oil, has a reddish colour. I am informed that the *essence de petit grain* is frequently substituted for it.

3. OIL OF THE RIND OF THE BITTER ORANGE.—This is sold by perfumers as *essential oil of bitter orange*. It has a considerable resemblance to the oil of the sweet orange.

PHYSIOLOGICAL EFFECTS AND USES.—The *rind* of the Seville orange being considerably more bitter than that of the sweet orange, is to be regarded as more stomachic and tonic. Its uses are the same. Its principal value is as a flavouring agent.

1. INFUSUM AURANTII COMPOSITUM, L. D.; *Infusum Aurantii*, D.; *Compound Infusion of Orange Peel.* (Bitter Orange Peel, dried, ℥ss. [ʒiij. *D.*]; [Lemon Peel, ʒij. *L.*]; Cloves, bruised, ʒj. [ʒss. *D.*]; Boiling [distilled] Water, Oj. [Oss. *D.*] Digest for a quarter of an hour in a vessel lightly covered, and strain [through linen or calico, *E.*; infuse for half an hour, *D.*])—An agreeable stomachic. It is an excellent vehicle for the exhibition of various other medicines, as saline purgatives, ammonia, bitter tinctures, &c.—Dose, f℥j. to f℥ij.

2. CONFECTIO AURANTII, L.; *Conserva Aurantii*, E.; *Confection of Orange Peel.* (Orange Peel separated by a rasp, lb. j.; Sugar, lbs. iij. Beat the rind in a stone mortar with a wooden pestle; then, the sugar being added, again beat them until they are thoroughly incorporated, *L.*—Grate off the rind of bitter oranges, and beat it into a pulp, adding gradually thrice its weight of white sugar, *E.*)—An agreeable stomachic.

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[1] *Nouv. Traité de Pharm.* i. 454.

Employed as an adjunct to bitter and purgative powders, which are to be formed into electuaries. It is a good vehicle for the exhibition of the sesquioxide of iron.

3. **SYRUPUS AURANTII**, L. E. D.; *Syrup of Orange Peel.* (Dried Bitter Orange Peel, ℥iss.; Boiling Water, Oj.; Pure Sugar, lb. iij. [Rectified Spirit, ℥iss. *L.*] Macerate the peel in the water for twelve hours, in a vessel lightly covered; boil for ten minutes, strain the liquor, and proceed as for the Syrupus Althææ, *L.* [add the sugar, and dissolve with the aid of heat, *E.*])—To avoid the volatilisation of the essential oil, as little heat as possible should be employed in the process. The *Dublin College* orders as much sugar as may be necessary. An equally agreeable and efficacious syrup may be prepared by adding f℥j. of tincture of orange peel to Oj. of simple syrup. Syrup of orange peel is stomachic, but its principal use is for flavouring.—Dose, fʒj. to fʒiij.

4. **TINCTURA AURANTII**, L. E. D.; *Tincture of Orange Peel.* (Bitter Orange Peel, dried, ℥iiiss. [℥iv. *D.*]; Proof Spirit, Oij. Macerate for seven [fourteen, *D.*] days [and express strongly, *E.*], and filter the liquor. "This tincture may be prepared by percolation, by cutting the peel into small fragments, macerating it in a little of the spirit for twelve hours, and beating the mass into a coarse pulp before putting it into the percolator," *E.*)—This tincture is an agreeable stomachic, and is principally employed as a flavouring adjunct to decoctions and infusions (tonic or purgative), effervescing mixtures, &c.—Dose, fʒj. to fʒiij.

5. **AQUA FLORIS AURANTII**, L.; *Aqua Aurantii*, E.; *Orange-flower Water.*—[This preparation is now removed to the Materia Medica of the London Pharmacopœia.—ED.] Orange-flower water is usually imported. That prepared from the flowers of the bitter orange possesses the most fragrant odour, but it is sometimes prepared from the flowers of the sweet orange. It contains free acetic acid, derived from the flowers; hence, if kept in a vessel of lead or copper, it acquires a metallic impregnation. The presence of lead in it has recently been pointed out by Mr. Squire.[1] The following are the characters of the pure orange-flower water:—

"Nearly colourless: unaffected by sulphuretted hydrogen."—*Ph. Ed.*

Sulphuretted hydrogen produces, with either lead or copper, a dark-coloured precipitate. Orange-flower water is employed in medicine, as well as in perfumery, on account of its agreeable odour.

AQUA COLONIENSIS; *Eau de Cologne; Cologne Water.*—A much-admired perfume. Two varieties are known in the shops—the *French* and the *German;* the latter fetches the highest price. Both profess to be made by Farina. The recipes for making it are numerous. I subjoin one, which is said, by Trommsdorff,[2] to be followed in the Cologne manufactories:—Oil of Neroli; Oil of Citron; Oil of Bergamot; Oil of Orange; Oil of Rosemary: of each twelve drops; Malabar Cardamoms, ʒj.; Rectified Spirit, Oj. Distil.—Eau de Cologne forms an agreeable evaporating lotion in headache, fever, &c. It should be applied by means of a single layer of linen.

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[1] *Brit. Ann. of Med.* for Jan. 1837, p. 15.

[2] *Journ. d. Pharm.* xviii. 79.

[Ægle Marmelos (Correa), or Indian Bael.[1]

The *bark of the root*, and especially the *half-ripe fruit*, of this plant having been sometimes used as astringents in the treatment of dysentery, a short notice of this plant and of its medicinal products is subjoined.[2]

BOTANY.—*Flowers* bisexual. *Calyx* 4-5 toothed. *Petals* 4-5 patent. *Stamens* 30-40; *filaments* distinct; *anthers* linear-oblong. *Ovary* 8-15 celled; *ovules* numerous in each cell. *Style* very short and thick. *Stigma* capitate. *Fruit* baccate, with a hard rind, 8-15-celled; *cells* 6-10 seeded. *Seed* coat woolly, covered with a slimy liquid. *Trees* with simple spines. *Leaves* pinnate; *leaflets* 3, occasionally, but very seldom, 5, oblong or broad-lanceolate, crenulated, inconspicuously dotted, unequal, the terminal one the largest. *Peduncles* axillary, few-flowered, *pedicels* long. *Flowers* large. Middle leaflet petiolate, lateral ones almost sessile; common petiole terete (Wight and Arnott).

A tolerably large and erect tree; *bark* ash-coloured; *branches* few and irregular. *Thorns* axillary, in pairs, single, or none, very sharp and strong; *leaves* ternate; *panicles* small, terminal and axillary; *flowers* large and white; *berry* large, sub-spherical, smooth, with a hard shell, from 10 to 15-celled; the cells contain, besides the seeds, a large quantity of an exceedingly tenacious transparent mucus, which on drying becomes very hard, but continues transparent; when fresh, it may be drawn out into threads of one or two yards in length, and so fine as to be scarcely perceptible to the naked eye, before it breaks. Seeds from six to ten in each cell, oblong, a little compressed, woolly, attached to the inner angle of their cell.

Hab.—It is a native of Malabar and Coromandel.

MEDICINAL USES.—The bark of the root, the bark of the stem, the leaves, the flowers, and the fruit, are used in India.

1. *The bark of the root.*—Baboo Ram Comal Shen[3] states, that the bark of the root is peeled while fresh, and a decoction of it made, in the proportion of about an ounce to a pint of water, reduced to about one-half by boiling. The dose is two or three tablespoonfuls from two to six times a day, in bilious fevers, palpitations, hypochondriasis, and melancholia.

2. *The bark of the stem* is said, by the same authority, to be sometimes used in fever, but rarely alone, being more usually one of those mixtures which are known as combinations of fourteen or eighteen substances, and given in remittents. When used alone it is given in a similar decoction as the bark of the root.

3. *The expressed juice of the leaves*, diluted sometimes with a little water, is commonly given in colds and incipient fevers, when the patient complains of general dulness, pains in his limbs, and sense of fulness of stomach. The juice is slightly bitter and pungent, and induces perspiration. The young leaves are also used in ophthalmia, and are made warm and so applied to the eyes to relieve pain and inflammation.

4. Dr. Roxburgh mentions that the *flowers* are reckoned refrigerant by the Malabar physicians.

5. *The rind of the fruit* is used in dyeing yellow; and the fruit itself is employed both in the unripe and ripe states.

The *unripe* or *half-ripe fruit*, in which the medicinal properties of the plant are most decidedly manifest, is declared to be a valuable and efficacious remedy in dysentery and all affections of the bowels accompanied by relaxation, and also in cases of irritation of the mucous membrane of the stomach and bowels. Although it relieves diarrhœa and dysentery, it does not constipate the bowels of those who are not troubled with these complaints. The unripe fruit is cut into small slices and dried, and in this state is used in the form of *decoction*, prepared with two ounces of the dried fruit and a pint of water. The mixture is to be gently simmered down to one-fourth, and of this the dose must depend on the attendant circumstances of the case. In bad cases of diarrhœa and dysentery, three tablespoonfuls are to be taken every two or three hours; in milder cases, the like quantity three or four times a day; and in mild cases of irritation, two or three times a day will be sufficient. To prevent or relieve flatus, two tablespoonfuls may be taken immediately after each meal. The *wine*, made with sherry and an *extract* of the dried fruit, has also been used. A *preserve* is prepared from the unripe fruit, by boiling with syrup. This is given to patients labouring under bowel complaints.

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[1] From a paper by the author in the *Pharmaceutical Journal*, October, 1850.

[2] *Trans. Linn. Society*, vol. v. p. 222.

[3] *Trans. Med. and Phys. Society of Bengal*, vol. iv.

The active or astringent principle of the unripe fruit is a modification of tannin. There is also much mucilage in the fruit. The *ripe fruit* is said to be delicious, and exceedingly fragrant. Dr. Horsefield[1] states, that in Java it is considered to possess astringent qualities. Sir W. Jones observes of it, that it "is nutritious, warm, cathartic; in taste delicious, in fragrance exquisite; its aperient and detersive quality, and its efficacy in removing habitual costiveness, have been proved by constant experience." A sort of *sherbet* is prepared from it with tamarind-juice, which is beneficial in fevers and inflammatory affections attended with thirst. A *jelly* and a *preserve* are made of the ripe fruit with sugar, and are used beneficially by those who labour under habitual costiveness and irritation of stomach.

The glutinous mucus surrounding the seeds is used by painters as a size and varnish; and, according to Royle, is considered an excellent addition to mortar, especially in well-digging.]

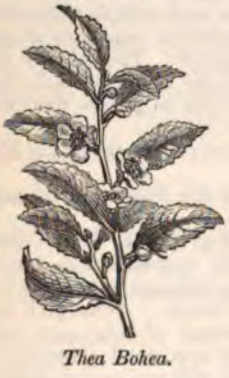
OTHER MEDICINAL AURANTIACEÆ.

The **FERONIA ELEPHANTUM**, a large tree growing in most parts of India, yields a gum which is used for medicinal purposes by the practitioners of Lower India. It is an exudation of the stem, and closely resembles gum Arabic.[2] It is not improbable that part of the *East India gum* brought to this country may be the produce of this tree.

ORDER LXXIV. TERNSTRÖMIACEÆ, *Lindley*.—THE TEA TRIBE.

Though unable to do more than bestow a passing notice on **TEA**, I cannot wholly omit all reference to this important and interesting substance. Two kinds of Tea plant are cultivated in our green-houses; the one called *Thea viridis* or *Green Tea*, the other *Thea Bohea* or *Black Tea*. Great discrepancy of opinion exists as to whether the different varieties of tea of commerce are obtained from one or from two species.[3] The well-known differences between green and black teas lend great support to the assertions of those who contend that these teas are obtained from different plants growing in different provinces of China. Mr. Reeves's observations on this point[4] appear to me exceedingly apposite. In commerce, two principal kinds of tea are distinguished,—the *Black* and *Green*: to the first belong *Bohea*, *Congou*, *Campoi*, *Souchong*, *Caper*, and *Pekoe*; to the latter *Twankay*, *Hyson-skin*, *Hyson*, *Imperial*, and *Gunpowder*.[5] Frank[6] analysed both black and green teas, and obtained the following results:—

FIG. 96.



Thea Bohea.

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[1] Quoted by Ainslie in his *Materia Indicæ*, vol. ii. p. 189.

[2] Ainslie, *Mat. Ind.* i. 161.

[3] See Royle's *Illustr.* p. 109; and Hooker, *Bot. Mag.* t. 3148.

[4] See Royle, *op. cit.*

[5] For some interesting observations on *Assam Tea*, see Royle's *Essay on the Productive Resources of India*, Lond. 1840; and Bruce's *Report on the Manufacture of Tea, and on the Extent and Produce of the Tea Plantations in Assam*, in Jameson's *Journal*, xxviii. 126, 1840.

[6] Gmelin, *Handb. d. Chem.* ii. 1252.

	Black.	Green.
Tannin	40·6	34·6
Gum	6·3	5·9
Woody fibre	44·8	51·3
Glutinous matter	6·3	5·7
Volatile matter, and loss	2·0	2·5
Tea	100·0	100·0

Sir H. Davy[1] found more tannin in black than in green tea, in the proportion of 48 to 41. But these results are opposed to our daily experience, as derived from flavour, which indicates the greater astringency in the green tea, and to the experiments of Mr. Brande.[2] The difference in the quantity of tannin in the two kinds of tea is, however, not very great. A few years ago, Oudry[3] announced the existence in tea of a crystalline, salifiable base, to which he gave the name of *theina;* but more recently Jobst[4] has asserted its identity with *caffein*, already noticed.

[THEINE.—This identity of *theine* with *caffeine* is now very generally admitted by chemists. The common formula for the two is $C^{18}H^{10}N^{4}O^{4}$.[5] Theine is also identical with *Guaranine*, discovered by Dr. Martins of Erlangen in *Guarana officinalis.* The substance known as *Guarana*, is a species of chocolate manufactured from the fruit of the Paullinia Sorbilis, by the inhabitants of Peru and Brazil. *Theine* is also a constituent of the *Ilex Paraguayensis* or *Paraguay* tea-plant: but it is here associated with vegetable principles, which, according to our taste, give a mixed disagreeable flavour of hay and tobacco. Theine may be procured by precipitating a decoction of tea with a slight excess of acetate of lead, and evaporating the filtered liquid to dryness. The dry mass mixed with sand is heated and the theine or caffeine sublimes in crystals. Tea yields generally more than one per cent. Dr. Stenhouse has lately compared the amount of theine yielded by the different substances containing this principle. It appears from his results that there is no substance which yields so large a proportion as Guarana. 100 parts of each yielded:

	Theine.
Guarana	5·07
Good Black Tea	2·13
Black Tea from Kemaon, East Indies	1·97
Various samples of Coffee Beans	0·8 to 1·00
Dried Coffee Leaves from Sumatra	1·26
Paraguay Tea from Ilex Paraguayensis	1·20[6]

It is remarkable that substances apparently so different, and selected as common beverages, should owe their leading dietetic properties to the presence of one and the same principle.—ED.]

Dr. R. D. Thomson[7] has described a fixed oil (*Tea Oil*) obtained from the tea plant. It is composed of *elaine* 75, and *stearine* 25. Notwithstanding the extensive employment of tea as an article of diet, yet it is no easy matter to ascertain correctly its precise *effects* on the constitution. Its astringency is proved by its chemical properties: and hence tea may be resorted to as an easily accessible antidote in cases of poisoning by substances containing vegetable alkalies or by emetic tartar. Another quality possessed, especially by green tea, is that of diminishing the tendency to sleep. Hence, like coffee, tea is often resorted to by those who desire nocturnal study. Moreover, it may be employed as an antisoporific to counteract the effects of opium and intoxicating liquors; and Dr. Clutterbuck[8] has suggested its application to the relief of the stupor of fever, which he considers to be nearly allied to intoxication. Tea appears to possess a sedative influence with regard to the vascular system: and in this, as well as in the watchfulness which it produces, tea somewhat resembles foxglove. On account of its sedative power, Dr. T. Percival[1] recommends its use in feverish and inflammatory diseases, and I can speak from frequent observation of its good effects in these maladies. To this power should also be referred the relief of headache experienced by the use of tea. In colds, catarrhs, and rheumatism, warm infusion of tea is frequently employed as a diluent, diaphoretic, and diuretic. Strong green tea taken in large quantities is capable, in some constitutions, of producing most distressing feelings;[2] and of operating as a narcotic. Dr. Lettsom[3] found that a strong infusion of tea introduced into the abdomen of a frog caused paralysis of the hind extremities of the animal.[4]

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[1] *Phil. Trans.* for 1803, p. 268.

[2] *Quart. Journ.* xii. 201.

[3] Thomson, *Org. Chem.* p. 295.

[4] *Ann. d. Pharm.* xxv. 63, 1838.

[5] See *antè*, p. 68, where the formula is given for Caffeine, on the authority of Liebig, at one half of these numbers.

[6] *Pharmaceutical Journal*, vol. xvi. p. 212.

[7] Jameson's *Journal*, xxii. 380.

[8] *Inquiry into the Seat and Nature of Fever*, 2d edit. p. 434.

ORDER LXXV. DIPTERACEÆ, *Lindley*.—THE DIPTEROCARPUS TRIBE.

DIPTEROCARPEÆ, *Blume*.

DRYOBALANOPS AROMATICA, Gaertner (*D. Camphora*, Colebrooke; *Shorea camphorifera*, Roxb.) is a large tree growing in Sumatra and Borneo. From its stem are obtained a liquid called *Camphor oil*, and a crystalline solid denominated *Sumatra* or *Borneo Camphor*.

1. *Liquid Camphor; Camphor Oil.*—Is obtained by making deep incisions into the tree with an axe. The oil gushes out, and is received in bamboos or other convenient utensils.[5] It is occasionally imported into this country in tin canisters. It is sometimes perfectly limpid, transparent, and colourless; but more usually it is more or less coloured, being yellow or brownish. Its odour is somewhat analogous to that of oil of cajuputi, combined with the odour of camphor and cardamoms. Some samples have a strong odour of turpentine. This oil has been analysed by Martius.[6] The mean of three analyses gave him for its constituents *carbon*, 83·129, *hydrogen*, 11·346, and *oxygen*, 5·25: or $C^{20}H^{16}O^{8}$. Recently Pelouze[7] has analysed it. He regards it as a hydrocarbon, whose formula is $C^{20}H^{16}$. By exposure to the air it rapidly oxidises and becomes $C^{20}H^{16}O^{4}$. Hence, therefore, it would appear that Martius must have analysed an oxidised oil. Camphor oil has been employed in the preparation of scented soap. Sixty pounds of dark brown oil yielded forty pounds of colourless liquid oil, and twenty pounds of crystalline camphor.

2. *Sumatra* or *Borneo Camphor*. By the natives of Sumatra it is termed *Kapūr-barus* (i. e. *Baroos Camphor*).—It is found in the natural fissures or crevices of the wood, and is obtained by cutting down the tree, dividing it transversely into several blocks, which are split with wedges into small pieces, from the interstices of which the camphor, if there be any, is extracted.[8] After being separated from impurities, it is packed in *catties*. Being much esteemed by the Chinese, it fetches a very high price. According to Mr. Crawford[9] its value is 78 times that of Japan camphor! It rarely comes to this country as a commercial article. For some of the samples in my museum I am indebted to the late Mr. Gibson (of the firm of Howard, Jewell, and Gibson, of Stratford), who stated that "they are part of two very small boxes imported about twenty years ago, which were bought by me at the common price of camphor at the time, but which it was afterwards discovered were invoiced at an enormous price. Our firm gave them up to the importers, reserving samples, and they were re-shipped

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[1] *Essays*, vol. i.

[2] Dr. E. Percival, *Dublin Hosp. Rep.* i. 219.

[3] *Natural History of the Tea Tree*, 1772.

[4] For some interesting information on Tea, see Dr. Sigmond's work, entitled *Tea, its Effects, Medicinal and Moral*, 1839.

[5] Prince, Roxb. *Fl. Ind.* ii. 616.

[6] *Berlin. Jahrbuch*, xl. 464, 1838.

[7] *Journ. de Pharm.* xxvi. 646.

[8] Marsden, *History of Sumatra*, 3d edit. p. 150.

[9] *History of the Indian Archipelago*, iii. 418.

for India. I never, on any other occasion except one, saw a small specimen of what I have named *native camphor*."

Sumatra or Borneo Camphor occurs in small white fragments of crystals. They are transparent, brittle, and have a camphoraceous odour and a hot taste. According to Pelouze its crystalline form is a prism with six regular faces, and derived from the rhombohedric system. It is lighter than water,—very slightly soluble in that liquid; but very soluble in alcohol and ether. It is fusible and volatile. Its composition, according to Pelouze, is $C^{20}H^{18}O^{2}$.

Sumatra Camphor is distinguished from Common or Laurel Camphor by several characters; such as the form of the crystals above mentioned; their greater hardness, so that when shaken in a bottle they produce a ringing sound; they are more brittle, and do not so readily sublime and condense in crystals in the upper parts of the bottle.

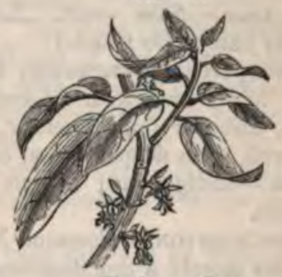
Its medicinal properties are probably similar to those of ordinary or laurel camphor. But in the East, especially by the Chinese, the most extravagant virtues are assigned to it, and it is accordingly highly valued. In the *Puntsaou* it is called Lung Naou Heang, or "Dragon's Brain perfume."

ORDER LXXVI. BYTTNERIACEÆ, *De Candolle.*—THE CACAO TRIBE.

The THEOBROMA CACAO is a native of the West Indies and of Continental America.

Its seeds (*nuclei cacao*) when torrefied, and with various additions (sugar, and usually either cinnamon or vanilla), made into a paste, constitutes *chocolate* (*chocolata*), which furnishes a very nourishing beverage, devoid of the ill properties possessed by both tea and coffee, but which, on account of the contained oil, is apt to disagree with dyspeptics.[1] *Cocoa* is another preparation of these seeds. It is said to be made from the fragments of the seed-coats mixed with portions of the kernels. It is somewhat astringent, and is adapted for persons with relaxed bowels.

FIG. 97.



Theobroma Cacao.

ORDER LXXVII. MALVACEÆ, *R. Brown.*—THE MALLOW TRIBE.

CHARACTERS.—*Calyx* of 5 (rarely 3 or 4) sepals, more or less coherent at the base, valvate in æstivation, often with bracts or external sepals forming an involucre or outer calyx. *Petals* as many as the sepals, and alternate with them; hypogynous, equal; spirally contorted in æstivation, generally adnate to (but sometimes distinct from) the lower part of the tube of the stamens. *Stamens* equal in number, or more commonly a multiple of the petals; generally indefinite (rarely definite), hypogynous. *Filaments* united into a tube, and unequal in length, the outer ones being shorter. *Anthers* 1-celled, uniform, dehiscing by a transverse chink. *Ovary* of many carpels, generally verticillated round the axis, and coherent (sometimes free). *Styles* as many as the carpels, either distinct or united. *Stigmas* as many as the carpels, more or less distinct. *Carpels* either 1- or 2- seeded, and dehiscing inward by a chink, or polyspermous, with a loculicidal dehiscence, or having a septum in the middle which bears the seeds on the inner side; in some cases nearly free, in others united into a many-celled capsule or an anomalous berry. *Albumen* none. *Embryo* straight. *Radicle* terete. *Cotyledons* twisted like a chrysalis.—*Herbs, shrubs,* or *trees.* *Leaves* alternate, generally petiolate, and with stipules (De Cand.)

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[1] For particulars respecting the manufacture of chocolate, see Ure, *Dictionary of Arts*, p. 292; and Soubeiran, *Traité de Pharm.* i. 447.

PROPERTIES.—"The uniform character is to abound in mucilage, and to be totally destitute of all unwholesome qualities" (Lindley).

331. MALVA SYLVESTRIS, *Linn. E.*—COMMON MALLOW.

Sex. Syst. Monadelphia Polyandria.

(Herb, *E.*)

HISTORY.—According to Dr. Sibthorp,[1] the Μαλάχη χερσαία of Dioscorides[2] is the *Malva sylvestris.*

BOTANY. **Gen. Char.**—*Calyx* 5-cleft, persistent, surrounded by an involucel of usually 3, rarely 1 or 2, or 5 or 6, more or less oblong or setaceous bracteoles. *Ovary* with many cells, each with 1 ovule. *Styles* as many as the cells. *Carpels* several (rarely only 5), capsular, indehiscent, 1 seeded, circularly arranged around the axis. *Radicle* inferior (Wight and Arnott).

Sp. Char.—*Stem* erect. *Leaves* 5- to 7-lobed, acute. *Pedicels* and *petioles* hairy (De Cand.)

Root perennial, tapering, branching, whitish. *Stem* 2 or 3 feet or more high, branched. *Leaves* deep green, soft and downy. *Flowers* large, three or four together, axillary. *Petals* obcordate, purplish-rose coloured, with deeper veins, combined by the base of their claws.

Hab.—Indigenous; hedges and road sides. Flowers from June to August.

DESCRIPTION.—Common Mallow (*herba malvæ sylvestris*) is odourless, and has merely a mucilaginous herbaceous taste. Its watery infusion is deepened in colour by the sesquichloride of iron, and forms a precipitate with acetate of lead. Dwarf mallow (*herba malvæ rotundifoliæ*) possesses similar properties.

COMPOSITION.—I am unacquainted with any analysis of this plant. The constituents are probably similar to those of Althæa officinalis. *Mucilage* is the prevailing principle. *Extractive* also is another constituent. The *colouring matter* of the flower is an exceedingly delicate test of alkalies, which render it green.

PHYSIOLOGICAL EFFECTS AND USES.—Emollient and demulcent. Employed in the form of decoction, in irritation of the alimentary canal, and of the pulmonary and urinary organs. In tenesmus, the decoction is used in the form of enema. In external inflammations, emollient fomentations and cataplasms of mallow are sometimes employed.

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[1] *Prodr. Fl. Græc.* ii. 45.

[2] Lib. ii. cap. 144.

332. ALTHÆA OFFICINALIS, *Linn. L. E.*—COMMON MARSH-MALLOW.

Sex. Syst. Monadelphia Polyandria.
(Folia; Radix, *L.*—Leaves; Root, *E.*)

HISTORY.—According to Dr. Sibthorp[1] this plant is the Ἀλθαία of Dioscorides.[2]

BOTANY. **Gen. Char.**—*Calyx* surrounded by a 6- to 9-cleft involucel. *Carpels* numerous, capsular, closely and circularly arranged round the axis (Wight and Arnott).

Sp. Char.—*Leaves* softly tomentose on both sides, cordate or ovate, toothed, undivided, or somewhat 3-lobed. *Peduncles* axillary, many-flowered, much shorter than the leaf (De Cand.)

Root perennial, tap-shaped, rather woody. *Stem* 2 or 3 feet high. *Leaves* hoary green, peculiarly soft and downy, with a fine starry pubescence. *Flowers* 3 or 4 together, on axillary stalks, large pale rose coloured.

Hab.—Indigenous; marshes, especially near the sea.

DESCRIPTION.—The leaves of Marsh-mallow (*foliæ althææ*) are odourless, and have a mucilaginous taste. The root (*radix althææ*) is long, cylindrical, branched, about the thickness of the finger, plump, mucilaginous, white internally, and covered with a yellowish epidermis. That which is imported from France has been deprived of its epidermis, and is white (*decorticated root of marsh-mallow*). Its odour is feeble; its taste sweet and mucilaginous. Iodine colours it dark blue. Sesquichloride of iron forms with the concentrated decoction a brown semi-transparent gelatinous mass.

COMPOSITION.—Marsh-mallow root has been analysed by Bacon,[3] by L. Meyer,[4] by Wittstock,[5] and by Buchner.[6] The results of the latter chemist are as follows:—*Fatty oil* 1·26, *glutinous matter* 1·81, *uncrystallisable sugar* and *althein* 8·29, *mucilage* 35·64, *starch* 37·51, *phosphate of lime* 8·29, *vegetable medulla* 11·05, and *woody fibre* 7·50 [excess 11·35].

ASPARAGIN; *Asparamide; Althein.*—The substance which has been called *althein* is identical with *asparagin.* It is crystallisable, odourless, and almost tasteless. It is soluble in water and alcohol, sp. gr. 0·837; but it is insoluble in absolute alcohol and in ether. It consists of $C^8H^7N^2O^5$. Acted on by the watery solutions of the alkalies, it evolves ammonia, and is converted into *aspartic acid* ($C^8H^5NO^6$): hence it is called *asparamide*, as it is an aspartite of ammonia ($C^8H^5NO^6+H^3N$), minus an atom of water. It has an influence on the therapeutic properties of the root.

PHYSIOLOGICAL EFFECTS AND USES.—Similar to those of common mallow, already stated. On the continent it is a favourite demulcent. The *pastilles* and *pate de guimauve* are used as pectorals. The powder of marsh-mallow root is used in France to envelope pills. "The simple decoction is recommended as an injection, to be thrown into the vagina, in cases of difficult labour, arising from rigidity of the soft parts."[1]

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[1] *Prodr. Fl. Græc.* ii. 42.

[2] Lib. iii. cap. 163.

[3] *Journ. de Chim. Méd.* ii. 551.

[4] Gmelin, *Handb. d. Chem.* ii. 1251.

[5] *Pharm. Central-Blatt für* 1831, S. 277.

[6] *Ibid. für* 1832, S. 511.

1. **MISTURA ALTHÆÆ**, E.; *Marsh-mallow Mixture.* (Root of Althæa, ℥iv.; Raisins, stoned, ℥ij.; Boiling Water, Ov. Boil down to three pints; strain through linen or calico, and when the sediment has subsided, pour off the clear liquor for use).—An agreeable diluent and demulcent. Employed in visceral inflammation and irritation; as nephritis, calculous affections, gonorrhœa, and strangury. From one to three pints may be taken in the course of the day.

2. **SYRUPUS ALTHÆÆ**, L. E.; *Syrup of Marsh-mallows.* Take of Althæa (the marsh-mallow root sliced ℥iss.; of sugar three pounds, or as much as may be sufficient. Distilled water Oj.; rectified spirit ℥iiss. or as much as may be sufficient. Macerate the Althæa in the water for twelve hours. Press out the liquor and strain through linen. Then to the strained liquor add twice its weight of sugar, and dissolve with a gentle heat. Lastly, when the syrup has cooled, mix with each fluid ounce of it half a fluid drachm of spirit. L. Take of Althæa root fresh and sliced, ℥viij.; boiling water Oiv.; Pure Sugar, lbs. iiss. Boil the root with the water down to two pints; strain and express strongly through calico and let the impurities subside. Dissolve the sugar in the liquor with the aid of heat. Boil down to a proper consistence).—Demulcent, employed as an adjunct to cough mixtures, and as a pectoral for children. It readily ferments, and becomes ropy.—Dose, fʒj. to f℥ss.

333. GOSSYPIUM HERBACEUM, *Linn. E.*—COMMON COTTON.

Sex. Syst. Monadelphia Polyandria.
(Hairs attached to the seed, *E.*)

HISTORY.—It is somewhat doubtful who first mentioned cotton. There is some reason for supposing that cotton cloth is referred to in the Old Testament.[2] Cotton (*βύσσος*), is mentioned by Herodotus;[3] but he or his translators are in error, in stating[4] that the Egyptians, in embalming, wrapped the body in cotton cloth; since all mummy cloths are found, on a microscopic examination, to be linen.[5] Pliny[6] speaks of the cotton plant (*Gossypion*) and of the cloth (*Xylina*) made of the woolly substance which envelopes the seeds.[7]

BOTANY. **Gen. Char.**—*Calyx* cup-shaped, obtusely 5-toothed, surrounded by a 3-leaved involucel, with the leaves united and cordate at the base, and deeply cut or toothed irregularly. *Style* simple, marked with 3 or 5 furrows towards the apex. *Stigmas* usually 3, sometimes 5.

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[1] Montgomery, *Obs. on the Dubl. Pharm.*

[2] Harris, *Natural History of the Bible*; Carpenter, *Scripture Natural History.*

[3] *Thalia*, cv.

[4] *Euterpe*, lxxxvi.

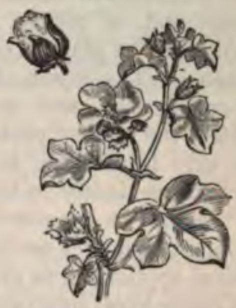
[5] Dutrochet, in Jameson's *Journal*, vol. xxiii. p. 320. This author suggests that the βύσσος of Herodotus was the filamentous weavable matter which lint [flax] supplied.

[6] *Hist. Nat.* lib. xix. cap. 2, ed. Valp.

[7] For further historical details, see Royle's *Illustr.* p. 84, et seq.

Capsules 3- to 5-celled, 3- to 5-valved at the apex, loculicidal. *Seeds* numerous, imbedded in cotton.[1] Young *branches* and *leaves* more or less conspicuously covered with little black dots; nerves below usually with one or more glands (Wight and Arnott).

FIG. 98.



Gossypium herbaceum.

Sp. Char.—Bi-tri-ennial; *young parts* hairy. *Leaves* hoary, pulmate, with sub-lanceolate, rather acute lobes. *Stipules* falcate-lanceolate. *Leaves* of the exterior calyx dentate. *Capsules* ovate pointed. *Seeds* free, clothed with firmly adhering white down under the long white wool (Roxburgh).—*Petals* of a lively yellow colour, with a purple spot near the claw. Dr. Roxburgh[2] particularly distinguishes three varieties cultivated in India—viz. the *Dacca*, the *Berar*, and the *China* cottons.

Hab.—Asia. Cultivated in India, Syria, Asia Minor, the Mediterranean, and America.

DESCRIPTION.—The filamentous substance, called *cotton* (*gossypium*), consists of tubular hairs, which arise from the surface of the seed-coat. By drying, they become flattened; and in this state, if they be immersed in water and examined by the microscope, they appear like distinct, flat, narrow ribands, with only occasional appearances of joints, which are indicated by a line at a right angle, or nearly so, to the side of the tube. Cotton is distinguished (under the microscope) from the vegetable fibre which constitutes linen by the tubes of the latter being in bundles, round, tapering at the extremities, and, when jointed, having oblique articulations. Cotton which has undergone no preparation is denominated *raw cotton.*[3]

COMPOSITION.—Cotton is a modification of *lignin*, and consists, therefore, of *carbon*, *hydrogen*, and *oxygen*; but the precise relative proportions of its constituents have not been ascertained. In all its essential chemical properties it agrees with ordinary woody fibre. It is completely insoluble in water, alcohol, ether, oils, and vegetable acids. Strong alkaline leys dissolve it. The strong mineral acids decompose it. With nitric acid it yields oxalic acid.

PHYSIOLOGICAL EFFECTS AND USES.—*Internal.* [The only part of the plant which has been employed internally is an infusion of the seeds, under the name of *Cotton seed tea.* It is stated to have been used very successfully in intermittent fevers, in cases in which large and frequent doses of quinine had failed. Dr. Davis made inquiry into its use in South Carolina, U.S., where the plant is indigenous, and it would appear that it is there considered a valuable domestic medicine, although its alleged anti-periodic properties have not as yet been tested by the profession.[4]—ED.]

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[1] [An oil of a siccative nature, and of a dark colour, has been recently extracted by pressure from these seeds.—ED.] *Pharm. Journal*, xvi. 335.

[2] *Fl. Ind.* iii. 184.

[3] For much interesting information regarding Cotton, but which is unsuited to this work, consult Royle, *op. cit.*; M'Culloch, *Dictionary of Commerce*; and Ure, *Dictionary of Arts.*

[4] *Transactions of American Medical Association*, vol. iii. p. 319.

External.—Raw cotton, or cotton wool, has been employed with apparently good effect in the treatment of burns.[1] It allays pain and irritation, apparently by forming, with the discharges, a substitute for the epidermis, under the protection of which the process for the formation of the new cuticle takes place, undisturbed by external irritation. The exclusion of the air seems to be a most important part of the treatment; and, of course, to effect this, many other agents (as lint) will answer in the place of cotton. The following is the method of employing cotton:— The cotton should be carded in narrow fleeces, thin enough to be translucent, and applied in successive layers, so as completely to protect the injured parts from the effects of motion and pressure. When the skin is severely scorched, a spirituous or turpentine wash may be applied previously to the application of the cotton. As complete repose of the part is necessary, the first dressing should be allowed to remain as long as possible undisturbed. Raw cotton has also been used as a topical application in erysipelas.[2]

Cotton-wool, impregnated with nitre or chlorate of potash, has been employed as moxa.

The well-known superiority of linen to cotton, as a dressing for wounds and ulcers, is usually ascribed to the triangular shape of the cotton fibres, the sharp angles of which are supposed to cut and irritate the flesh. But this shape of the fibres exists only in the imagination of those who have never examined them by the microscope. Raspail[3] ascribes the superiority of linen for surgical purposes to the hollow condition of the tubular fibrillæ, by which they are enabled to absorb into their interior the blood or purulent secretion. The tubes of cotton, on the other hand, are filled with an organising substance, and, therefore, can imbibe nothing into their interior.

[**GUN-COTTON**; *Xyloidine.*—The discovery of this singular compound was made by Schönbein.[4] There are numerous formulæ for its preparation. Two are given below under the head of Collodion. The subjoined formula is similar to that recommended by Schönbein. A mixture of nitric and sulphuric acids is used in place of the nitrate of potash and sulphuric acid. To five parts by measure of sulphuric acid (SG 1·840) add five parts by measure of nitric acid (SG 1·510). Mix them thoroughly, then immerse in the mixture one part of clean and well dried cotton-wool pulled out, to every ten parts by weight of the mixed acids. Stir well for two minutes, or until the fibre of the cotton is thoroughly penetrated by the acids. Remove the mass, press out the acids, wash rapidly in two or three waters, pulling out the cotton and agitating it to remove acidity; then wash it in water containing a small quantity of ammonia, and wash it again in water to remove any sulphate or nitrate of ammonia.

If allowed to remain for a long period soaking in water, its properties are damaged. The last washing should be tasteless, and should not affect litmus paper. The cotton may then be dried at a gentle heat in a water-bath.

Although but little changed in appearance, there is a great difference in weight, 100 parts of cotton forming 169·5 parts of gun-cotton. Of this, according to Gregory, 67 parts, or only two-thirds of the original weight, are cotton-fibre, representing anhydrous cotton, while the remaining 102·5 parts are anhydrous nitric acid. Hence, 33 parts of cotton are lost by conversion to water and soluble products.

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[1] Anderson, *Edinb. Med. and Surg. Journ.* xiii. 215, 1828.

[2] *Lond. Med. Gaz.* Nov. 8, 1839.

[3] *Chim. Organ.*

[4] A paper comprising the early history of the discovery of Gun-cotton, was published by the author in the *Pharmaceutical Journal* for November, 1846, vol. vi. No. 5.

The use of the sulphuric acid is to withdraw water from the nitric acid and the compound left (gun-cotton), according to Porret and Teschemacher, is

$$\underbrace{C_{12}H_8O_8}_{\text{Anhydrous Cotton.}} + 4NO_5.$$

PROPERTIES. — It is highly electric on friction. It is insoluble in water, but readily soluble in ether when mixed with a little alcohol. If well prepared it explodes by percussion and is converted to gases: — namely, carbonic acid, deutoxide of nitrogen, aqueous vapour, and probably nitrogen. While gunpowder requires a heat of upwards of 500° to inflame it; gun-cotton, when well prepared, explodes at a heat of 300°. Its explosion takes place with such rapidity that it may be easily exploded over gunpowder without inflaming it. When well made, it should leave no carbonaceous residue. If exploded on litmus paper it reddens it; if on starch paper, moistened with iodide of potassium, the nitrous acid formed produces the blue iodide of farina. The only pharmaceutical use to which it is put is in the preparation of collodion.—ED.]

[**COLLODIUM.** *Collodion,* U.S.; also *Pharm. Norveg.* The United States formula is as follows: Take of cotton freed from impurities and finely carded, ℥ss.; Nitrate of potash in powder, ℥x.; Sulphuric acid, ℥viiiss.; Ether, Oiiss.; Alcohol, ℥j. Add the sulphuric acid to the nitrate of potash in a Wedgwood mortar, and triturate them until uniformly mixed; then add the cotton, and by means of a pestle and a glass rod, imbue it thoroughly with the mixture for four minutes. Transfer the cotton to a vessel containing water, and wash it in successive portions by agitation and pressure, until the washings cease to have an acid taste, or to be precipitated on the addition of chloride of barium. Having separated the fibres by picking, dry the cotton with a gentle heat, dissolve it by agitation with the ether previously mixed with the alcohol, and strain. Collodion should be kept in closely stopped bottles previously well dried. The first part of the above process produces *gun cotton,* which is afterwards dissolved in ether. It is a transparent solution of syrupy consistence and ethereal smell. It is used as an application in surgery to wounds, with a view of producing adhesion of the edges. When applied, the ether evaporates, producing a film which is the bond of union.

The *Norwegian formula* is as follows: Take of Nitrate of potash finely powdered, twenty parts. Place it in a glass vessel and add to it, of Sulphuric acid, sp. gr. 1·84, thirty-two parts. Stir the mixture with a glass pestle until the nitre is completely dissolved. Then plunge into it one part of the best carded American cotton, well pulled out, so that the liquid may penetrate into every part. Cover the vessel with a glass plate and let it digest twenty-four hours at a temperature of about 86°. Remove the cotton and wash it with tepid water until all trace of sulphuric acid is removed. Dry it with a gentle heat.

Of the cotton thus prepared, to which the name of gun cotton is applied, take one part. Place it in a bottle with a narrow neck, and add to it of ether sixteen parts, and of alcohol at ·833, four parts. Agitate until the cotton is dissolved. Then pour off from any sediment.—ED.]

[USES.—Collodion is applied to many uses in medicine, surgery, and pharmacy. In chapped hands, chapped nipples, and fissures of the anus it has been employed with great success as an adhesive, and for the protection of the affected parts. In chapped nipples, while it relieves the female it is not injurious to the infant. It has been used in various cutaneous diseases attended with excoriation; in ulcers; in superficial burns and wounds; and as a stopping, applied on cotton, to carious teeth. Among the pharmaceutical uses may be mentioned the property of investing pills with a layer of cotton. Aloetic, colocynth and other pills may be coated by placing them on the point of a needle and dipping them into the collodion twice, allowing the first coat to dry before the second is applied.[1]

Collodion containing a certain proportion of an alcoholic solution of iodide or bromide of potassium is largely used in photography.—Ed.]

Order LXXVIII. LINACEÆ, *Lindley*.—THE FLAX TRIBE.

Lineæ, *De Candolle*.

Characters.—*Calyx* 3- or 4-, generally 5-sepaled. *Sepals* coherent only at the base, imbricate in æstivation, continuous with the peduncle, and therefore persistent. *Petals* as many as the sepals; hypogynous, unguiculate at the base, slightly united together, and to the ring of the stamens; alternate with the sepals, twisted in æstivation. *Stamens* equal in number, and alternate with the petals, cohering into a monadelphous ring at the base, and having an abortive filament, or tooth, between each. *Anthers* innate, bilocular, bi-rimose. *Ovaries* subglobose, with as many cells as there are sepals, rarely fewer. *Styles* as numerous as the cells of the ovary. *Capsule* globose, crowned by the permanent bases of the styles, composed of carpels having induplicate margins and dehiscing at the apex by two valves, and which are divided into partial cells, by an incomplete dissepiment arising from the centre. *Seeds* in each cell two inverted. *Albumen* generally none, but in its stead there is a tumid, fleshy endopleura. *Embryo* straight, with the radicle turned towards the hilum.—*Herbs* or *shrubs* with entire exstipulate *leaves* (De Cand.)

Properties.—The fibres of Linaceæ have great tenacity. The seeds abound in oil and mucilage, and are in consequence emollient.

334. LINUM USITATISSIMUM, *Linn. L. E. D.*—COMMON FLAX.

Sex. Syst. Pentandria Pentagynia.

(Semina; Oleum e seminibus expressum, *L. D.*—Seeds; Meal of the seeds deprived of their fixed oil by expression; Expressed oil of the seeds, *E.*)

History.—From time immemorial flax has been employed in the manufacture of cloth; and it appears from our most ancient records that Egypt was celebrated for its production.[2] Dutrochet[3] asserts that mummy cloth is made of flax.

Botany. **Gen. Char.**—*Sepals* 5, distinct, quite entire or serrated. *Petals* 5. *Stamens* 5. *Styles* 3 to 5, distinct from the base, or combined to the middle or apex (Wight and Arnott).

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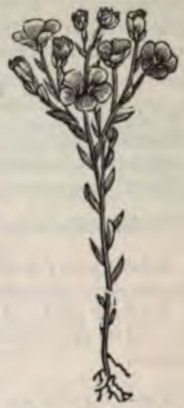
[1] The dry film left by the evaporation of collodion is rendered powerfully electric by the slightest friction.

[2] *Exodus*, ix. 31; Herodotus, *Euterpe*, cv.

[3] Jameson's *Journal*, xxiii. 221.

FIG. 99.



Linum usitatissimum.

Sp. Char.—Smooth, erect. *Leaves* lanceolate or linear. *Panicle* corymbose. *Sepals* ovate, acute, with membranous margins. *Petals* somewhat crenate, larger by three times than the calyx (De Cand.)—Annual. One or two feet high. *Leaves* distant. *Flowers* large, purplish-blue. *Capsule* globular, about the size of a small pea.

Hab.—Indigenous; corn fields; not unfrequent. Extensively cultivated in this, as well as in other European countries, both for its fibre for making thread, and for its oil obtained from the seeds.

DESCRIPTION.—The seed of the flax, commonly termed *linseed* or *lintseed* (*semina lini*), is small (about a line long), oval, oblong, flattened on the sides with acute edges, pointed at one extremity, smooth, glossy, brown externally, yellowish-white internally, odourless, and has an oily mucilaginous taste. The seed-coat is mucilaginous; the nucleus oily. The *cake* (*placenta lini*) left after the expression of the oil, is usually denominated *oil cake;* it forms, when ground to a fine powder, *linseed meal* (*farina lini*). The best oil cake for the preparation of linseed meal is the English fresh made. Foreign cake is of inferior quality. The colour of linseed meal is greyish-brown. It abounds in mucilage. The meal prepared by grinding the unpressed seeds yields a considerable quantity of oil.

The substance termed *flax* is prepared from the fibrous portions of the bark of the plant.[1] The short fibres which are removed in heckling constitute *tow* (*stupa*), which is employed both in pharmacy and surgery. Of flax is made *linen* (*linteum*), which, when scraped, constitutes *lint* (*linteum carptum; linamentum*), an important agent to the surgeon.[2]

COMPOSITION.—Linseed has been analysed by L. Meyer.[3] Its constituents he found to be as follows: *fat oil* (in the nucleus) 11·265, *wax* (in the husk principally) 0·146, *acrid soft resin* (in the husk principally) 2·488, *resinous colouring matter* 0·550, *yellow extractive with tannin* and *salts* (nitre and the chlorides of potassium and calcium) 1·917, *sweet extractive* with *malic acid* and some *salts*, 10·884, *gum* (in the nucleus) 6·154, *nitrogenous mucilage* with *acetic acid* and *salts* (in the husk principally) 15·120, *starch* with *salts* (in the husk) 1·480, *albumen* (in the nucleus) 2·782, *gluten* (in the nucleus) 2·932, *husk* and *emulsion* (?) 44·382. The ashes contained *oxide of copper*.

1. FIXED OIL.—(See p. 562.)

2. MUCILAGE OF LINSEED.—Has been examined by Bostock,[4] by Vauquelin,[5] and by Guerin-Varry.[6] Resides in the seed coats. Is extracted by hot water. When the solution is mixed with alcohol, white mucilaginous flocks are precipitated. Diace-

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[1] See Ure's *Dictionary of Arts*, p. 482.

[2] [A microscopical examination shows that much of the *Lint* now sold consists of scraped cotton.—ED.]

[3] Gmelin, *Handb. d. Chem.* ii. 1251.

[4] *Nicholson's Journal*, xviii. 31.

[5] *Ann. de Chim.* lxxx. 314.

[6] *Journ. de Chim. Méd.* vii. 739.

tate of lead forms a precipitate in it. Neither infusion of nutgalls nor chlorine has any effect on it. It is not coloured blue by iodine. It reddens litmus (owing to the free acetic acid). It consists of two parts: one soluble, the other insoluble in water. Its ashes contain carbonates of potash and lime, phosphate of lime, chloride of potassium, sulphate of potash, oxide of iron, alumina, and silica.

Proximate Analysis.	
Soluble part	52·70
Insoluble part	29·89
Ashes	7·11
Water	10·30
Mucilage of Linseed	100·00

Ultimate Analysis.	
Carbon	34·30
Hydrogen	5·69
Nitrogen	7·27
Oxygen	52·74
Mucilage of Linseed	100·00

α. *Soluble part* (*Arabine?*) soluble in cold water. Treated with nitric acid, yields 14·25 per cent. of mucic acid, besides some oxalic acid.

β. *Insoluble part.* A nitrogenous substance, not soluble in water, and not yielding mucic acid by the action of nitric acid. Properly speaking, therefore, it is not a gummy substance.

PHYSIOLOGICAL EFFECTS.—Linseed is emollient and demulcent. It also possesses nutritive qualities; for, in the form of a thick mucilage (or jelly, as it is termed), it is employed for fattening cattle. *Linseed cake* is also employed for a similar purpose. *Linseed oil* is a mild laxative.

USES.—Employed, to allay irritation, in the form of *infusion* or *tea*, *expressed oil*, and *meal*.

1. INFUSUM LINI COMPOSITUM, L.; *Infusum Lini*, E.; *Linseed Tea.* (Linseed, bruised, ʒvj.; Liquorice Root, bruised, ʒij.; Boiling [distilled, *L.*] Water, Oj. Digest near the fire, in a lightly covered vessel, and strain [through linen or calico, *E.*])—Employed as an emollient and demulcent in irritation and inflammation of the pulmonary and urinary organs, and of the mucous membranes generally; as gonorrhœa, dysentery, alvine irritation, and pulmonary affections. It is rendered more palatable by the addition of sliced lemon and sugar-candy.—Dose, f℥ij. to f℥iv. or *ad libitum.*

[**2. DECOCTUM LINI COMPOSITUM**, D.; *Compound Decoction of Linseed.* —(Take of Linseed, ℥j.; Liquorice Root, bruised, ʒss.; Water, Oiss. Boil for ten minutes in a covered vessel, and strain while hot.)—ED.]

3. OLEUM LINI, L. E. D.; *Linseed Oil.*—To prepare this oil, the seeds are first bruised or crushed, then ground, and afterwards subjected to pressure in the hydraulic or screw press.[1] *Cold-drawn linseed oil* (*oleum lini sine igne*) is paler coloured, less odorous, and has less taste, than linseed oil prepared by the aid of a steam heat of about 200° F. (*oleum lini*, offic.); but, according to Mr. Brande,[2] it "soon becomes rancid and more disagreeable than that expressed at a higher temperature." The seeds yield by cold expression 18 or 20 per cent. of oil; but by the aid of heat from 22 to 27 per cent. Linseed oil is usually amber-coloured; but it may be rendered quite colourless. For a fine sample of colourless oil I am indebted to Mr. Whipple. Linseed oil has a peculiar odour and taste; it is soluble in alcohol, but more readily so in ether. When exposed to the air it dries into a hard, transparent varnish. This change is greatly accelerated by boiling the oil, either alone or with litharge, with sugar of lead or with common white vitriol. The resulting oil is called *drying oil* or *boiled oil.* The efficacy of the process is ascribed by Liebig[1] to the elimination of substances which oppose the oxidation of the oil. The ultimate composition of linseed oil, according to Saussure, is *carbon* 76·014, *hydrogen* 11·351, and *oxygen* 12·635. Its proximate constituents are *oleic acid* (chiefly), *margaric acid*, and *glycerin.*—Rarely employed internally. Its most ordinary use is for the preparation of *Linimentum calcis*, already (Vol. I. p. 619.) described.[2]

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[1] See Ure's *Dictionary of Arts*, p. 899.

[2] *Dict. of Pharm.*

4. **FARINA LINI**, E.; *Linseed Meal.* (The meal of the seeds deprived of their fixed oil by expression, *E.*)—Emollient. Employed in the preparation of the *linseed-meal poultice.* It is a constituent of the *pulvis pro cataplasmate*, D., already noticed.—The farina of the unpressed linseed is preferred to the powder of linseed-cake, on account of its oleaginous quality. What is usually sold as such has been prepared from recently pressed English oil cake.

5. **CATAPLASMA LINI**, L.; *Linseed Meal Poultice.* (Boiling Water, ℥x.; Linseed, powdered, ℥ivss., or as much as may be sufficient. Add the water by degrees to the linseed, stirring constantly that a poultice be made.)—A valuable emollient poultice.

335. LINUM CATHARTICUM, *Linn. E.*—PURGING FLAX.

Sex. Syst. Pentandria Pentagynia.
(Herb, *E.*)

HISTORY.—First mentioned by Thalius in the sixteenth century.[3]

BOTANY. **Gen. Char.**—See *Linum usitatissimum.*

Sp. Char.—Smooth, erect. *Leaves* opposite, obovate-lanceolate. *Stem* above dichotomous (De Cand.)

Annual. Stem slender, 2 to 6 inches high. *Flowers* drooping before expansion, white, small.

Hab.—Indigenous; pastures: common.

DESCRIPTION.—Purging flax (*herba lini cathartici*) is odourless, but has a very bitter taste.

COMPOSITION.—I am unacquainted with any analysis of this plant. Probably its purgative principle is *bitter extractive.*

PHYSIOLOGICAL EFFECTS AND USES.—Cathartic and occasionally diuretic; but somewhat uncertain in its operation. Formerly used in rheumatism. Now almost obsolete.—Dose, ʒj. of the dried plant; or an infusion of a handful of the fresh plant may be employed.

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[1] *Journ. de Pharm.* xxvi. 193.

[2] [Since the publication of the first volume of this work, the Linimentum Calcis has been introduced into the London Pharmacopœia:—Take of Solution of Lime and Olive Oil, each ten fluidounces: shake them together. The Dublin College orders of Lime Water and Olive Oil, each two fluidounces.—ED.]

[3] Sprengel, *Hist. Rei Herb.* i. 35.

Order LXXIX. CARYOPHYLLACEÆ — THE CHICKWEED TRIBE.

Caryophylleæ, *Jussieu; De Candolle.*

Characters.—*Calyx* generally persistent, of 4 or oftener 5 sepals, which are continuous with the pedicel, and either free or coherent into a 4- or 5-dentate tube, imbricate in æstivation. *Petals* as many as the sepals (very rarely 0), inserted on the torus, which is more or less elevated on a pedicel (anthophorus), alternate with the sepals, unguiculate, having the fauces sometimes crowned with petaloid scales. *Stamens* as many as, or double the number of, the petals inserted in the torus. *Filaments* subulate, sometimes submonadelphous at the base. *Anthers* 2-celled. *Ovary* simple, 2- to 5-valved, inserted at the apex of the torus, and crowned by an equal number of styles. *Capsule* of 2 to 5 valves, united at the base, dehiscing at the apex, generally 1-celled, sometimes 2- to 5-celled. *Septa* protruding from the middle of the valves, incomplete or continuous to the axis. *Placenta* central. *Seeds* numerous (very seldom few or definite); *albumen* farinaceous, generally central; *embryo* usually peripherical, more or less incurved (seldom central and straight); *radicle* directed towards the hilum.—*Herbs* or *under-shrubs*, with opposite entire *leaves*. *Stems* jointed (De Cand.)

Properties.—Remarkable, for the most part, for their insipidity and consequent inactivity.

336. DIANTHUS CARYOPHYLLUS, *Linn.*—CLOVE PINK; CARNATION, OR CLOVE GILLYFLOWER.

Sex. Syst. Decandria Digynia.
(Flores).

History.—First noticed by Manfredus de Monte Imperiali.[1]

Botany. **Gen. Char.**—*Calyx* tubular, 5-toothed, imbricated at the base, with 2 to 4 opposite scales. *Petals* 5, with long claws. *Stamens* 10, *Styles* 2. *Capsule* 1-celled. *Seeds* compressed, convex on one side, concave on the other; peltate. *Embryo* scarcely curved (De Cand.)

Sp. Char.—*Stem* branched. *Flowers* solitary. *Scales* of the calyx 4, very short, ovate, somewhat mucronate. *Petals*, very broad, beardless. *Leaves* linear-awl-shaped, channelled, glaucous (De Cand.)

A *perennial* plant; the origin of the fine carnations of the gardens. *Flowers* pink, purple, white, or variegated; double, semi-double, or single.[2]

Hab.—Indigenous. Cultivated in gardens.

Description.—The red or deep crimson gilly-flowers (*flores dianthi caryophylli; flores caryophylli rubri; flores tunicæ*) were formerly employed in medicine on account of their colour. They have a pleasant aromatic smell, and a bitterish sub-astringent taste. They communicate to water their smell and colour.[3]

Composition.—I am unacquainted with any analysis of them. They obviously contain *a volatile oil*, *colouring matter*, and an *astringent principle*.

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[1] Sprengel, *op. supra cit.* i. 298.

[2] For horticultural information respecting them, consult Loudon's *Encyclopædia of Gardening.*

[3] Lewis, *Mat. Med.*

PHYSIOLOGICAL EFFECTS AND USES. — Formerly supposed to have an influence over the nervous system to raise the spirits, &c. Simon Pauli[1] recommended them in various nervous and spasmodic affections, and in malignant fever. They have also been used as flavouring and colouring agents; and a *syrup* of them was formerly contained in the British Pharmacopœias.

ORDER LXXX. POLYGALEÆ, *De Candolle*. — THE MILKWORT TRIBE.

POLYGALACEÆ and KRAMERIACEÆ, *Lindley*.

CHARACTERS. — *Sepals* 5, imbricate in æstivation, the two interior generally petaliform, the three exterior smaller; two of them are interior and sometimes united, the third is posterior. *Petals* 3 to 5, hypogynous, more or less united by means of the tube of the stamens (rarely distinct). *Filaments* of stamens adherent to the petals, monadelphous, divided at the apex into two opposite equal phalanges. *Anthers* 8, 1-celled, innate, dehiscing by pores at the apex. *Ovary* 1, free, 2-celled, rarely 1- or 3-celled. *Style* 1. *Stigma* 1. *Pericarp* capsular or drupaceous, 2- or 1-celled. *Valves* septigerous in the middle. *Seeds* pendulous, solitary, often with a carunculate arillus at the base; *embryo* straight, generally in the axis of a fleshy albumen, (or rarely) exalbuminous, in which case the endopleura is tumid. *Herbs* or *shrubs*. *Leaves* entire, generally alternate, articulated on the stem (De Cand.)

PROPERTIES. — Leaves and roots for the most part bitter and astringent.

337. POLYGALA SENEGA, *Linn. L. E. D.* — THE SENEKA.

Sex. Syst. Diadelphia Octandria.
(Radix, *L.*—Root, *E. D.*)

HISTORY. — The root of this plant was introduced into medicine as a remedy for the bites of venomous animals, in the early part of the last century, by Dr. Tennant, a Scotch physician, residing in Pennsylvania.[2]

BOTANY. **Gen. Char.**—*Sepals* persistent, the two inner ones wing-like. *Petals* 3 to 5, adnate to the tube of the stamen; the inferior one keel-shaped (perhaps composed of two united). *Capsule* compressed, elliptical, or obcordate. *Seeds* pubescent, carunculated at the hilum, destitute of a coma (De Cand.)

Sp. Char.—*Stems* several, somewhat erect, simple, terete. *Leaves* ovate-lanceolate, the upper ones acuminate. *Racemes* somewhat spiked. *Wings* orbiculate. *Capsule* elliptical, emarginate (De Cand.)

Root perennial, branching. *Stems* annual, from 9 to 12 inches high, occasionally tinged at their lower part with red or purple. *Leaves* alternate, sessile, or on very short stalks, paler beneath. *Flowers* small, white. *Alæ* of the calyx white, with green veins. *Capsule* small, containing two blackish *seeds*.

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[1] *Quadrip. Bot.* p. 241.
[2] *An Epistle to Dr. Mead*, 1742.

Hab.—United States of America: most abundant in the southern and western parts.

DESCRIPTION.—*Senega* or *Seneka* root (*radix senegæ* seu *senekæ*), sometimes called the *seneka-snakeroot* or the *rattlesnake root*, is imported from the United States in bales. It varies in size from that of a writing-quill to that of the little finger; it is contorted, presents a number of eminences, and terminates superiorly in an irregular tuberosity, which exhibits traces of numerous stems: a projecting line extends the whole length of the root. The cortical portion is corrugated, transversely cracked, thick, of a greyish-yellow colour. The central portion (*meditullium*) is woody and white. The taste of the root is at first sweetish and mucilaginous, afterwards acrid and pungent, exciting cough and a flow of saliva: its odour is peculiar and nauseous.

COMPOSITION.—Senega root has been repeatedly made the subject of chemical investigation. In the last century it was examined by Burckhard, by Keilhorn, and by Helmuth.[1] In 1804 it was analysed by Gehlen;[2] and in 1811 by Fougeron.[3] Peschier[4] also published an analysis of it. In 1826 it was analysed by Feneuille,[5] in 1827 both by Dulong d'Astafort[6] and by Folchi,[7] in 1832 by Trommsdorff,[8] and in 1836 by Quevénne.[9] I subjoin three of these analyses:

Trommsdorf.		*Dulong.*	*Quevénne.*
Volatile oil	*a trace*	Volatile oil, traces.	Polygalic acid.
Acrid resin	4·552	Acrid extractive.	Virgineic acid.
Sweetish bitter extractive	33·570	Yellow extractive.	Tannic acid.
Pectic acid	10·444	A substance reddened by sulphuric acid.	Pectic acid.
Wax	0·746	Pectic acid.	Cerin.
Soft resin...............	5·222	Wax.	Fixed oil.
Mucus	5·968	Resin.	Yellow colouring matter.
Woody fibre	34·316	Gum.	Gum.
Malates, potash, and lime	2·536	Woody fibre.	Albumen.
		Malates of potash and lime.	Woody fibre.
		Mineral salts and iron.	Salts, alumina, silica, magnesia, and iron.
Dried Senega Root	97·354	Senega Root.	Senega Root.

1. POLYGALIC ACID, in the impure state, was first procured by Gehlen, who called it *Senegin*. It is the active principle, and resides in the cortical part of the root. When pure it is a white odourless powder, which is at first tasteless, but afterwards communicates an acrid feeling to the mouth, and a sense of constriction to the fauces. It irritates the nostrils, and excites sneezing. It is volatile, and, when decomposed by heat in a glass tube, evolves no ammonia, and hence contains no nitrogen. It is soluble in water and in alcohol, especially when aided by heat; but it is insoluble in ether, acetic acid, and the oils. Its solution forms white precipitates (*polygalates*) with diacetate of lead and protonitrate of mercury. Sulphuric acid has a characteristic effect on polygalic acid: it renders polygalic acid yellow, then rose-red, and afterwards dissolves it, forming a violet-coloured solution, which becomes decolorised in twenty-four hours. The *alkaline polygalates* are not crystallisable. Polygalic acid

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[1] Murray, *App. Med.* ii. 564.
[2] Gmelin, *Handb. d. Chem.* ii. 1249.
[3] *Journ. de Chim. Méd.* ii. 549.
[4] Quoted by Goebel and Kunze, *Pharm. Waarenk.*
[5] *Journ. de Chim. Méd.* ii. 431.
[6] *Journ. de Pharm.* xiii. 567.
[7] *Journ. de Chim. Méd.* iii. 600.
[8] *Pharm. Central-Blatt für* 1832, S. 449.
[9] *Journ. de Pharm.* xxii.

consists of *carbon* 55·704, *hydrogen* 7·529, and *oxygen* 36·767; or $C^{22}H^{18}O^{11}$. It has considerable resemblance to esculic acid.[1] Given to dogs in doses of six or eight grains, it causes vomiting, embarrassed respiration, and death in three hours. Two grains thrown into the jugular vein caused vomiting, and, in two hours and a half, death.

5. VIRGINEIC ACID.—A volatile fatty acid, analogous to valerianic, phocenic, and butyric acids. It is an oily liquid, of a reddish colour, a strong, penetrating, disagreeable odour, and an acrid taste. It is soluble in alcohol, ether, and caustic potash, but scarcely so in water.

PHYSIOLOGICAL EFFECTS.—Senega possesses acrid and stimulant properties. In small doses it is diaphoretic, diuretic, and expectorant; in larger doses, emetic and purgative. Sundelin[2] took a scruple of powdered senega root every two hours for six hours: it caused irritation of the back part of the tongue and throat, and gave rise to an increased flow of saliva. These effects were soon followed by considerable burning in the stomach, nausea, and vomiting. The skin became warmer and moister; there was griping pain of the bowels, followed by watery evacuations; the secretion of urine was increased, and a feeling of heat was experienced in the urinary passages. For some days after there was gastric uneasiness, with loss of appetite. *In larger doses* it caused burning pain in the stomach and bowels, violent vomiting, purging, anxiety, and giddiness. It appears to excite moderately the vascular system, to promote the secretions (at least those of the kidneys, skin, uterus, and bronchial membrane), and to exert a specific influence over the nervous system. It has been principally celebrated for its expectorant effects.

In its operation on the nervous system it has considerable resemblance to Arnica; but its influence over the secreting organs is much greater. It is somewhat analogous to Helenium in its action.

USES.—In this country senega is comparatively but little employed. It is an exceedingly valuable remedy in the latter stages of *bronchial* or *pulmonary inflammation*, when this disease occurs in aged, debilitated, or torpid constitutions, and when the use of depletives is no longer admissible. It appears to re-establish a healthy condition of the secreting organs, to promote the resolution of the morbid deposits, and to give strength to the system. I usually administer it in combination with ammonia, which appears to me to promote its beneficial operation. Frequency of pulse, and a febrile condition of the system, are by no means to be regarded as impediments to the use of this medicine.

In *chronic catarrh* and *humoral asthma* it has also been used. It has been extravagantly praised by Dr. Archer of Maryland, as a remedy for *croup*.[3] He represents it as being capable, without the aid of any other means, of removing this alarming disease. Few practitioners, I suspect, would venture to trust it. Yet it might be a useful addition to emetics. As a stimulant and promoter of the secretions, it has been used with advantage in the latter stage of low *fever* accompanied with torpidity. It has also been used as an emetic, purgative, and diaphoretic, in *rheumatism*, as a diuretic in *dropsy*, and as an emmenagogue in *amen-*

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[1] *Journ. de Pharm.* xxiii. 270.

[2] *Handb. d. spec. Heilmittell.* ii. 176, 3te Aufl.

[3] Eberle, *Mat. Med.*

orrhœa. It was introduced into practice as a remedy against the bite of venomous animals,—as the rattlesnake.

ADMINISTRATION.—The dose of the *powder* is from grs. x. to ℈j. But the *infusion* or *decoction* is the best form of exhibition.

1. **DECOCTUM SENEGÆ**, L.; *Decoction of Senega.* (Senega Root, ʒx.; Distilled Water, two pints. Boil down to a pint, and strain.)—Stimulating, expectorant, and diuretic.—Dose f℥j. to f℥iij. three or four times daily. Ammonia is often a valuable addition to it.

[2. **INFUSUM POLYGALÆ**, D. (Polygala root, bruised, ℥ss.; Boiling Water ℥ix. Digest for one hour in a covered vessel and strain.) The product should measure about eight ounces.—ED.]

[3. **INFUSUM SENEGÆ**, E.; *Infusion of Senega.* (Take of Senega, ʒx.; Boiling Water, one pint. Infuse for four hours in a covered vessel, and strain.)—ED.]

[4. **SYRUPUS SENEGÆ**, U.S.; *Syrup of Seneka.* (Take of Seneka bruised, ℥iv.; Water, Oj.; Sugar, lb. j. Boil the water with the seneka to one half, and strain; then add the sugar, and proceed in the manner directed for syrup. Or take Seneka in coarse powder, ℥iv.; Water, a sufficient quantity; Sugar, ℥xv. Mix the seneka with four fluid ounces of water, and allow the mixture to stand for twelve hours; then put it into an open apparatus for displacement, and gradually pour water upon it until the liquid passes nearly tasteless. Evaporate the filtered liquor to half a pint, strain, and having added the sugar, proceed as for syrup.) This preparation possesses all the advantages of the decoction, to which, moreover, it is superior in its acceptability to the patient. It may be employed by itself or it may be combined with other articles, and employed in the form of a cough mixture. The dose is ʒj. to ʒij.—ED.]

[5. **EXTRACTUM SENEGÆ**; *Extract of Seneka.* The following formula for this preparation has been given by Mr. Procter in the *American Journal of Pharmacy*, Vol. xiv. p. 287. Take of Seneka in coarse powder, ℥xvj.; Alcohol, Oij.; Water, ℥iv. Mix the alcohol and water and macerate the seneka in one half of it for two days, place the mixture in a displacement apparatus, and operate with the same menstruum until six parts of tincture are obtained. Evaporate this in a water-bath until reduced to the consistence of an extract. One drachm of this extract dissolved in a pint of water yields a preparation of the same theoretical strength, but greater actual strength than the officinal decoction. It may be used in the same manner as the preceding by combination.—ED.]

338. KRAMERIA TRIANDRA, *Ruiz and Pavon, L. E. D.*—THE RHATANY.

Sex. Syst. Tetrandria Monogynia, *Willd.*
(Radix, *L.*—Root, *E. D.*)

HISTORY.—This plant was discovered by Ruiz and Pavon, in 1779, in South America. It was introduced to notice into this country, as a medicine, by Dr. Reece, in 1808. In 1813, Ruiz's dissertation on it appeared in an English dress.[1]

BOTANY. **Gen. Char.**—*Sepals* 4 or 5, irregular, coloured, spreading, deciduous. *Petals* 4 or 5, irregular, smaller than the calyx, the 3 inner unguiculate. *Stamens* 1, 3, or 4, hypogynous, unequal. *Ovary* 1-celled, or incompletely 2-celled; *style* terminal; *stigma* simple; *ovules* in pairs, suspended. *Fruit* between hairy and leathery, globose, covered with hooked prickles, by abortion 1-seeded, indehiscent.—Spreading, many-stemmed *undershrubs*. *Leaves* alternate, simple, entire or 3-foliate, spreading. *Racemes* simple, spiked (Lindley).

Sp. Char.—*Leaves* oblong, somewhat acute, villous-silky. *Pedicels* somewhat longer than the leaf, bibracteate, forming a short *raceme* (De Cand.)

Suffruticose. Root long, branching. *Stem* procumbent, branching. *Leaves* sessile, covered on both surfaces with long, silky leaves. *Flowers* solitary, lake-coloured. *Stamens* 3. *Drupe* round, beset with stiff reddish hairs.

Hab.—Peru and Bolivia, half-way up the western slopes of the Cordilleras, growing abundantly in Huanuco, Huamalies, and Canta.

DESCRIPTION.—Rhatany root *radix* (*krameriæ* seu *rhatanhiæ*) is brought from Peru. It is chiefly exported from Lima. It consists of numerous woody, cylindrical, long branches, varying in thickness from that of a writing-quill upwards. These pieces consist of a slightly fibrous, reddish-brown bark, having an intensely astringent and slightly bitter taste,—and of a very hard, ligneous meditullium, of a yellowish or pale red colour. The largest quantity of astringent matter resides in the bark, and therefore the smaller branches (which have a larger proportion of bark) are to be preferred. *Foreign* or *South American extract of rhatany* (*extractum krameriæ* seu *rhatanhiæ americanum*) is occasionally imported.

[**1. Peruvian or Payta Rhatany.**—The varieties of rhatany have been recently minutely examined by Dr. Schuchardt.[2]

We quote the following from his description of the characters of the root ordinarily known and derived from the *krameriæ triandra*.

"Druggists are in the habit of distinguishing two sorts of Payta Rhatany, one sort *stumpy*, or *short*, and another designated as *long*. If the root-diggers bestow the needful care in removing the roots from the soil, the *long* variety of the drug will be obtained; while in the *short*, stumpy, or chumpy form, it is plainly indicated that the shrubs have been torn from the soil with force, and that sufficient regard has not been had carefully to extract the long, creeping root. The *long* Rhatany is preferred to the *short* or stumpy variety. The stumpy sort occurs in pieces, from the lower part of which proceed numerous roots, some running in a perpendicular, but more in a tolerably regular horizontal direction. The aërial stem varies very much in length and thickness, number, and direction of the roots. In most cases, the stem of the Rhatany plant is cut off a few inches above the ground; its thickness varies from $\frac{1}{4}$ of an inch to 3 inches; it is not always perfectly cylindrical, but frequently irregular and knotty. One seron contained roots evidently collected with very little care, since to some of them, branched or simple stems from 1 to 2 feet long were still attached. The longest aërial stem which Dr. Schuchardt had the opportunity of seeing, measured 26 inches. Another and upright stem whose base of $3\frac{1}{8}$ inches in diameter, branched into three nearly equal shoots, was covered here and there, and especially on its broken ends, with a grey epidermis, upon which, besides some blackish *Verrucariæ*, there was a dark-fruited *Lecidea*, with a green thallus. Another seron contained principally the roots and stems of younger plants, which, at scarcely one inch above the ground, had divided into numerous branches and twigs, the latter clothed with a dense covering of long, silky, white, adpressed hairs. The foliaceous, thin, brittle, brown bark, is easily detached. The youngest branches still retained here and there the small oval leaflets, invested with the same covering of hair as the branches. According to the testimony of travellers, the rhatany plant is easily recognised, even at a distance, not only by its bright red flowers, but also by the silky, shining pubescence of the leaves. Under the microscope this pubescence is seen to consist of densely-crowded, long, one-celled, colourless, thick-walled, hollow hairs. According to the age of the plant, we find a difference in the external appearance, and more or less in the internal structure, of its stem—less so, however, in the roots."

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[1] Eckard, *Diss. Inaug. de Rad. Ratanhiæ*, Berol. 1822.

[2] *Pharmaceutical Journal*, July, 1856, xvi. p. 31.

[**2. New Granada or Savanilla Rhatany.**—A peculiar kind of rhatany root was met with by Dr. Schuchardt in the London drug market in the autumn of 1854, to which the name of *Savanilla rhatany* (from the place of import) has been given. It is also called *New Granada* rhatany. According to this gentleman, it is not the produce of the krameria triandra, which is not found in this part of South America.[1] He states that, "as regards external appearance, the stems of the Savanilla Rhatany are never so knotty and irregularly rounded as those of the old kind of Rhatany, but are more symmetrical and slender, more regularly cylindrical, and generally shorter. Its roots (we cannot speak of one principal root), as to thickness, are as different as those of the stumpy variety of Payta Rhatany, but never so long as those of Peruvian Rhatany sometimes are. Their anatomical structure readily admits of their being broken, without the bark thereby splitting off. Pieces of root from four to at most ten inches long, are the most frequent, and these with the root-stocks before described, to some of which are attached roots of from four to six inches, form the contents of the seron. The roots are marked with shallow, undulated furrows, which are near each other, but not always parallel. The roots are also marked, often all round, by deep, narrow, transverse cracks, which sometimes even lay bare the wood. The bark is united to the wood by a rather broad inner cortical layer, and adheres to it with firmness. This is considered by Dr. Schuchardt to be rather an important distinctive character.

"It is difficult, in fact almost impossible, briefly to define the colour of Savanilla Rhatany. It is a singular mixture of different shades, a mixture of cinnamon-brown and violet-red, dusted, as it were, with a fine leaden grey. If slightly rubbed with a soft substance, the bark assumes a peculiar, almost garnet-red lustre, which differs widely from the weaker and duller resinous appearance of Peruvian Rhatany. The adhesion of the bark to the wood is so strong in Savanilla Rhatany Root, that when broken in pieces, the bark always remains attached, which is never the case in Payta Rhatany, where, if so treated, the bark splits or peels off. The colour of the wood is yellowish-white, almost alike in both roots; its fracture in both the old and new sort of Rhatany, and in old as well as young roots, is of the same character, namely, short-splintery (*kurzsplitterig*). The fracture of the bark, on the other hand, is very different in the two sorts, as might be expected from the dissimilar texture of the layers. The bark of Payta Rhatany has a fibrous fracture, arising from the nature of its inner layer; the middle and outer layers break more evenly. The bark of Savanilla Rhatany has a nearly even fracture, its outer and middle layers presenting a somewhat powdery appearance.

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[1] *Pharmaceutical Journal*, August 1, 1856.

"The bark of Payta Rhatany, from its toughness, cannot be reduced to powder without considerable labour, but the bark of Savanilla Rhatany can be powdered without any particular difficulty. The powder of the latter is of a purplish red, resembling very much that of tormentilla root; while the powder of the root of Peruvian Rhatany is easily distinguished by its tint of brownish-red and cinnamon.

"If the characters and properties of *Savanilla Rhatany* will justify the opinion that it is derived from a new species of Krameria, and not the result of differences of climate and soil on Krameria triandra, that opinion is further supported by the difference in the anatomical structure of the two roots, which of itself indicates a specific difference."

3. West Indian Rhatany.—This variety of root is derived from *krameria ixine* (*radix ratanhiæ Antillarum*). It is chiefly the produce of the West India islands, and is exported to France from Martinique and Guadaloupe. It has, however, been found on the continents of America.—ED.]

[ADULTERATIONS.—Dr. Metterheimer of Gressen states that he once found this root adulterated with the radix calagulæ, an underground root of a *Polypodium* growing in Peru, and seldom met with in the German trade. It differs both in chemical and physical characters from rhatany root. The root of the variety above described as West Indian *krameria ixine* has been more frequently substituted for genuine rhatany. He has also met with a spurious rhatany root, the source of which is altogether unknown to him. When viewed in bulk this has a dirty violet red-brown colour. The pieces are not so tough as genuine rhatany, and break more easily, with a short fracture. When cut through, the centre has a dull pale red colour, without the dark points usually met with in genuine rhatany root. The false root has no colour; its taste is more strongly astringent than that of the true root.[1]—ED.]

COMPOSITION.—Rhatany root has been analysed by Trommsdorff, Vogel, C. G. Gmelin, and Peschier.[2]

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[1] *Pharmaceutical Journal*, vol. xi. p. 420.

[2] L. Gmelin, *Handb. d. Chem.* ii. 125.

C. G. Gmelin.	
Tannin	38·3
Sweet matter	6·7
Mucilage	8·3
Nitrogenous ditto	2·5
Lignin	43·3
[Loss	0·9]
Rhatany Root	100·0

Peschier.

Dried watery extract	31·25
Insoluble matters	68·75
Rhatany Root	100·00

Tannin	42·6
Gallic acid	0·3
Gum, extractive, and colouring matter	56·7
Krameric acid	0·4
Dried Watery Extract of Rhatany Root	100·0

1. TANNIC ACID.—To this, as well as in part to a minute portion of gallic acid, rhatany root owes its astringent qualities. It is this acid which enables an infusion of rhatany root to form, with a solution of gelatine, a precipitate (*tannate of gelatine*), and with sesquichloride of iron a brownish grey precipitate (*tannate of iron*). The properties of tannic acid have been already described.

2. KRAMERIC ACID.—Peschier ascribes the stypticity of rhatany to this acid, the properties of which are at present imperfectly known.

PHYSIOLOGICAL EFFECTS.—A powerful astringent, and like other agents of this class, tonic also. (See the effects of astringents, *ante*.)

USES.—Rhatany root is adapted to all those cases requiring the employment of astringents: such as *profuse mucous discharges* (as humid catarrh, old diarrhœas, fluor albus, &c.), *passive hemorrhages* (especially metrorrhagia), and *relaxation* and *debility of the solids*. It is sometimes used as a *tooth powder* (as with equal parts of orris root and charcoal). Dentists sometimes employ tincture of rhatany diluted with water *as an astringent mouth wash.*

ADMINISTRATION.—The *powder* may be given in doses of from grs. x. to ʒss. The *infusion* or *extract* is more commonly employed. *Compound tincture of rhatany* is prepared by digesting ℥iij. of bruised rhatany root, and ℥ij. of orange peel, in Oj. of proof spirit. Sometimes ℥ss. of serpentary root and ʒj. of saffron are added. It is an efficacious astringent and stomachic.—Dose, fʒj. to fʒiij.

1. INFUSUM KRAMERIÆ, L. D.; *Infusion of Rhatany.* (Krameria, ℥j. [℥ss. *D.*]; Boiling Distilled Water, Oj. [℥ix. *D.*] Macerate for four hours [one hour, *D.*] in a lightly covered vessel, and strain.) [The product should measure about eight ounces, *D.*]—Astringent and tonic. Dose, f℥j. to f℥ij.

2. EXTRACTUM KRAMERIÆ, E.; *Extract of Rhatany.* Prepared as extract of liquorice. Astringent.—Dose, grs. x. to ℈j.

[**3. TINCTURA KRAMERIÆ**, U. S. *Tincture of Rhatany.*—(Rhatany in powder, ℥vi.; Diluted Alcohol, Oij. Macerate for fourteen days, and strain, or prepare by displacement.)—Used as an adjunct to cretaceous mixtures, or with tonics. The dose is fʒj. to fʒij. It may be employed diluted with water as a gargle.]

[**4. SYRUPUS KRAMERIÆ**, U. S. *Syrup of Rhatany.*—(Extract of Rhatany, ℥ij.; Water, Oj.; Sugar, ℔ ijss. Dissolve the extract in the water, and make the solution into a syrup. A pleasant astringent, used in diarrhœas, chronic dysentery, and hemorrhages.)—Dose, fʒj. to f℥ss.—ED.]

ORDER LXXXI. VIOLACEÆ, *Lindley*. — THE VIOLET TRIBE.

VIOLARIÆ, *De Candolle*.

CHARACTERS.—*Sepals* 5, persistent, with an imbricate æstivation, usually elongate at the base. *Petals* 5, hypogynous, equal or unequal, usually withering, and with an obliquely convolute æstivation. *Stamens* 5, alternate with the petals, usually opposite them, inserted on a hypogynous disk, often unequal: *anthers* bilocular, bursting inwards, either separate or cohering, and lying close upon the ovary; *filaments* dilated, elongated beyond the anthers; two, in the regular flowers, generally furnished with an appendage or gland at their base. *Ovary* 1-celled, many-seeded, or rarely 1-seeded, with 3 parietal placentæ opposite the three outer sepals; *style* single, usually declinate, with an oblique hooded *stigma*. *Capsule* of 3 valves, bearing the placentæ in their axis. *Seeds* often with a tumour at their base; *embryo* straight, erect, in the axis of fleshy *albumen*. — *Herbaceous* plants or *shrubs*. *Leaves* simple, usually alternate, sometimes opposite, stipulate, entire, with an involute *vernation*. *Inflorescence* various. (Lindley.)

PROPERTIES.—Roots more or less emetic.

339. VIOLA ODORATA, *Linn. L. E.*—THE SWEET VIOLET.

Sex. Syst. Pentandria Monogynia.
(Petalum recens, *L.*—Flowers, *E.*)

HISTORY.—According to Dr. Sibthorp,[1] this is the Ιον *πορφυρόεν* (*purple violet*) of Dioscorides.[2] It was employed in medicine by Hippocrates.

BOTANY.—**Gen. Char.**—*Sepals* 5, unequal, prolonged into appendages at the base. *Corolla* unequal, 2-lipped, of 5 petals, the lower calcarate. *Capsule* bursting with elasticity, many-seeded, 3-valved.—*Herbaceous* plants (Lindley).

Sp. Char.—*Stigma* uncinate, naked. *Leaves* rounded, cordate. *Sepals* ovate, obtuse. *Spur* very blunt. *Capsule* turgid, hairy. *Seeds* turbinate, pale. *Runners* flagelliform (De Cand.)

Perennial. *Flowers* fragrant, deep purple, often white, occasionally lilac. *Bracts* inserted above the middle of the scape.

Hab.—Indigenous. Flowers in March and April. Cultivated on account of the odour and colour of the flowers.

DESCRIPTION.—Violets (*flores violæ odoratæ*) should be gathered immediately they are expanded, as they subsequently become purplish. Their delightful fragrance is well known. The root of the violet (*radix violæ odoratæ*) has been used in medicine.

COMPOSITION.—In 1822, Pagenstecher[3] detected the following substances in an infusion of the flowers:—*odorous principle, blue colouring matter, sugar* both *crystallisable* and *uncrystallisable, gum, albumen,* and

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[1] *Prodr. Fl. Græc.* i. 147.
[2] Lib. iv. cap. 122.
[3] Gmelin, *Handb. d. Chem.* ii. 1249.

salts of potash and *lime.* Boullay[1] obtained from the *root, leaves, flowers,* and *seeds,* an acrid principle, which he has termed *violine.*

1. ODOROUS PRINCIPLE.—This has not been isolated. It is supposed, however, to be of the nature of volatile oil. By digesting violets in olive oil, the latter dissolves the odorous matter, and acquires the smell of violets: this preparation is the *oil of violets,*—the *huile de violette* of perfumers. The *eau* or *esprit de violette* is nothing more than an alcoholic tincture of the rhizome of the Florentine orris, which has an odour similar to that of the violet.

2. COLOURING MATTER.—It is soluble in water, but not in alcohol. It is changed to red by the strong acids, and to green by the alkalies: hence the expressed juice and syrup are valuable as tests for discovering the existence of either acids or alkalies. An infusion of violets has been said to contain three kinds of colouring matter; namely, *a blue colouring matter,* not precipitable by the acetate of lead, but which is completely decolorised by sulphuretted hydrogen; secondly, *a bright-red acid colouring matter,* which causes a bluish-green precipitate with the solution of acetate of lead; thirdly, a *violet-red colouring matter,* which does not precipitate the neutral acetate of lead, but throws down a greenish-yellow precipitate with the subacetate of lead.

3. VIOLINE (*Emétine indigène*).—It was at first mistaken for *Emetina.* Its nature requires further investigation. It is a white powder, of a bitter acrid taste, slightly soluble in water, and insoluble in ether. It is precipitated from its solution by infusion of nutgalls. Its operation is similar to that of emetine.

PHYSIOLOGICAL EFFECTS.—The *odorous emanations* of violets, like those of some other flowers, are said to have occasionally proved dangerous, and in one case were supposed to have brought on apoplexy.[2] Dr. Lindley[3] has known them cause faintness and giddiness. *Taken internally,* violets act as laxatives. The *seeds* possess similar properties. The *root,* in doses of from ʒss. to ʒj., proves emetic and purgative.

USES.—Violets are employed in the preparation of the officinal syrup. They are useful as a test for acids and alkalies, and are much sought after for bouquets. The root might be employed as a substitute for ipecacuanha.

SYRUPUS VIOLÆ, L. E.; *Syrup of Violets.* (Of the Violet, ℥ix.; Boiling Distilled Water, Oj.; Sugar, lb. iij. or a sufficiency; Rectified Spirit, ℥iiss. or a sufficiency. Macerate the violet in water for twelve hours, then express and strain.—Set aside that the dregs subside, and proceed as directed for the Syrupus Althææ, *L.* Fresh Violets, *L.* lb. j.; Boiling Water, Oiiss.; Pure Sugar, lb. viiss. Infuse the flowers for twenty-four hours in the water [in a covered glass or earthenware vessel, *E.*]; strain without squeezing, and dissolve the sugar in the filtered liquor, *E.*)—The colour of this preparation is improved by making it in a tin or pewter vessel. No satisfactory explanation of this has been offered. The Edinburgh College, fearful, I presume, of metallic impregnation, direct glass or earthenware vessels to be employed.—Genuine syrup of violets is readily distinguished from any counterfeit by its being reddened by an acid, and made green by an alkali. Hence it is employed as a test.—As a medicine it is used as a mild laxative for new-born infants. Thus, a mixture of equal parts of oil of almonds and syrup of violets is often administered, in the dose of one or two teaspoonfuls, for the purpose mentioned.

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[1] *Journ. de Pharm.* x 23.

[2] Trillel, quoted by Murray, *App. Med.* i. 178.

[3] *Flora Medica.*

OTHER MEDICINAL VIOLACEÆ.

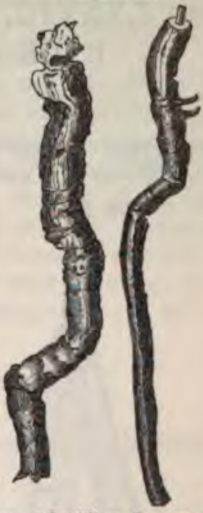
The roots of several species of *Ionidium* possess emetic qualities, and have been employed as substitutes for our officinal ipecacuanha (*Cephaëlis Ipecacuanha*).

The root of IONIDIUM IPECACUANHA, a native of the Brazils, is termed *False Brazilian Ipecacuanha.* It yielded Pelletier five per cent. of emetine. The dose of it, as an emetic, is ʒss. to ʒj. infused in water.

The root of the IONIDIUM MICROPHYLLUM, or the *Cuichunchully*, a native of Quito, possesses similar properties.

Dr. Bancroft[1] speaks favourably of it in Elephantiasis tuberculata. But the specimens which he sent home as Cuichunchully are said by Sir W. Hooker to be identical with *Ionidium parviflorum*, Vent. Dr. Lindley,[2] however, received from the Hon. W. F. Strangways the "Cuchunchully de Guença," which was the *I. microphyllum* of Humboldt.

FIG. 100.



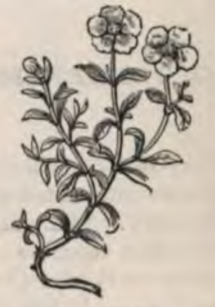
Root of Ionidium Ipecacuanha.

ORDER LXXXII. CISTACEÆ, *Lindley*.—THE ROCK-ROSE TRIBE.

CISTI, *Jussieu.* CISTÖIDEÆ, *Ventenat.* CISTINEÆ, *De Candolle.*

The substance called LADANUM is a resinous exudation from the *Cistus creticus*, growing, as its name implies, in Crete. In the time of Dioscorides it was collected by combing the beards of the goats which browse on the plant. According to Tournefort[3] and Sieber, it is now collected by a kind of whip or rake, with a double row of leathern thongs. With this the countrymen brush the plants, and when the whips are sufficiently laden with the juice, it is scraped off by knives, and made into cakes. Pure ladanum consists of *resin* and *volatile oil* 86, *wax* 7, *aqueous extract* 1, and *earthy matters* and *hairs* 7 (Guibourt). Pelletier found 72 per cent. of sand in it. It possesses stimulant properties, and was formerly a constituent of some plasters. Its use is now obsolete.

FIG. 101.



Cistus creticus.

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[1] *Comp. to Bot. Mag.* i. 278.

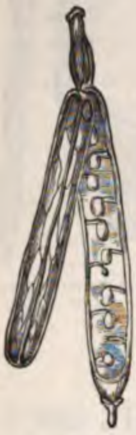
[2] *Flora Medica*, p. 98.

[3] *Voyage into the Levant*, i. 79, 1741.

ORDER LXXXIII. CRUCIFEREÆ, *Jussieu.*—THE CABBAGE OR CRUCIFEROUS TRIBE.

BRASSICACEÆ, *Lindley.*

FIG. 102.



A Silique.

CHARACTERS.—*Sepals* 4, deciduous cruciate. *Petals* 4, cruciate, alternate with the sepals. *Stamens* 6, of which two are shorter, solitary, opposite the lateral sepals, and ocasionally toothed; and four larger, in pairs, opposite the anterior and posterior sepals, generally distinct, sometimes connate, or furnished with a tooth on the inside. *Disk* with various green glands between the petals and the stamens and ovary. *Ovary* superior, unilocular, with parietal placentæ usually meeting in the middle, and forming a spurious dissepiment. *Stigmas* 2, opposite the placentæ. *Fruit* a silique or silicule, 1-celled, or spuriously 2-celled; 1- or many-seeded; dehiscing by two valves separating from the replum; or indehiscent. *Seeds* attached in a single row by a funiculus to each side of the placentæ, generally pendulous. *Albumen* none. *Embryo* with the radicle folded upon the cotyledons.—*Herbaceous* plants, annual, biennial, perennial, very seldom suffruticose. *Leaves* alternate. *Flowers* usually yellow or white, seldom purple (Lindley).

PROPERTIES.—Pungent stimuli. They furnish nutritive condimentary and antiscorbutic substances. Their pungency depends on an acrid volatile oil, composed of *carbon*, *nitrogen*, *hydrogen*, *sulphur*, and *oxygen*. This oil becomes absorbed, and in some cases is detectable in the secretions. The nutritive properties of cruciferæ arise from their mucilaginous, saccharine, and extractive constituents. *Cakile maritima* is purgative. *Cheiranthus lividus* is said to be dangerous to goats; while *Lepidum pisciaium* we are told stupifies fish. These statements, however, require further proof. With these doubtful exceptions none of the cruciferæ are poisonous.

340. CARDAMINE PRATENSIS, *Linn.*—CUCKOO-FLOWER.

Sex. Syst. Tetradynamia Siliquosa.

HISTORY.—Brunfels and Tragus are the earliest writers in whose works an undoubted notice of this plant appears.[1]

BOTANY. **Gen. Char.**—*Silique* linear, with flat, nerveless valves, which often separate elastically. *Seeds* ovate, not bordered (O=). *Umbilical cords* slender (De Cand.).

Sp. Char.—*Leaves* pinnatisect; segments of the radical ones somewhat rounded—of the cauline ones, linear or lanceolate, entire. *Style* very short, scarcely more slender than the silique; *stigma* capitate (De Cand.).

Root perennial. *Stem* about a foot high. *Flowers* light purple, flesh-coloured, or white.

Hab.—Indigenous; meadows and moist pastures. Flowers in April and May.

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[1] Sprengel, *Hist. Rei Herb.*

DESCRIPTION.—The flowers (*flores cardamines*) are somewhat bitter and pungent, and have a slight odour. By drying they become inodorous and almost insipid. The *leaves* possess a flavour analogous to, though less agreeable than, the common water-cress.

COMPOSITION.—I am unacquainted with any analysis of the plant worth quoting. The pungency depends on *volatile oil*, the bitterness on *extractive matter*. A few experiments on this plant are mentioned by Gronhert.[1]

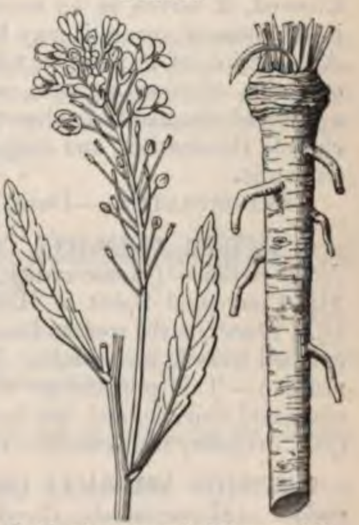
PHYSIOLOGICAL EFFECTS AND USES.—The flowers of cardamine are said to be stimulant, diaphoretic, diuretic, and nervine. They were formerly used in epilepsy, especially when it occurred in children, but have now fallen into almost total disuse. They were recommended by Sir George Baker[2] in cholera and spasmodic asthma.—Dose of the dried flowers, ʒij. or ʒiij.

341. COCHLEARIA ARMORACIA, *Linn. L. E.*—HORSE-RADISH.

Sex. Syst. Tetradynamia Siliculosa.
(Radix recens, *L.*—Fresh root, *E.*)

HISTORY.—Sprengel[3] considers this plant to be the *ῥαφανὶς ἀγρία* of Dioscorides;[4] and Dierbach[5] suggests that it was known to Hippocrates. But these opinions are by no means well established.

FIG. 103.



Cochlearia Armoracia (*Horse-radish*).

BOTANY. **Gen. Char.**—*Silicule* sessile, ovate-globose or oblong, with ventricose valves. *Seeds* many, not bordered. *Calyx* equal, spreading. *Petals* entire. *Stamens* not toothed (O=). *Flowers* white. *Leaves* often somewhat fleshy (De Cand.)

Sp. Char.—*Silicules* ellipsoid. Radical *leaves* oblong, crenate; cauline ones elongated, lanceolate, dentate, or incised. *Root* fleshy, large (De Cand.)

Root perennial, long, cylindrical, white, very pungent. *Stems* two feet high. *Leaves* much veined. *Flowers* white.

Hab.—Indigenous; extensively cultivated. Flowers in May.

DESCRIPTION.—Horse-radish root (*radix armoraciæ; radix raphani rusti-*

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[1] *Spec. Inaug.* Resiomonti, 1785.
[2] *Med. Trans.* i. 442.
[3] *Hist Rei Herb.* i. 182.
[4] Lib. ii. 138.
[5] *Arzneim. d. Hippok.* 125.

cani) evolves, when scraped into shreds, a highly penetrating acrid vapour. Its taste is very pungent. It is coloured blue by tincture of iodine. An infusion of it is tinged reddish yellow by the sesquisalts of iron.

COMPOSITION. — Horse-radish root was analysed by Gutret,[1] who found its constituents to be—*acrid volatile oil, bitter resin, extractive sugar, gum, starch, woody fibre, vegetable albumen, acetic acid,* and *acetate* and *sulphate of lime.*

VOLATILE OIL (*Oleum Armoraciæ*).—Obtained by distillation without water. It is of a pale yellow colour, heavier than water, and very volatile. Its odour is exceedingly powerful, and like that of horse-radish. One drop is sufficient to infect a whole room. Its taste is at first sweetish, then burning and acrid. It causes inflammation and vesication when applied to the skin. It is slightly soluble in water, easily so in alcohol. The watery solution yields, with acetate of lead, a brown precipitate (*sulphuret of lead*); with nitrate of silver, a black one (*sulphuret of silver*). [It contains sulphur and nitrogen, but no oxygen. It has lately been shown to be identical with Volatile Oil of Mustard. — ED.]

PHYSIOLOGICAL EFFECTS. — Horse-radish is a well-known pungent, acrid stimulant, capable of producing vesication when applied to the skin, and of causing vomiting, when taken, in the form of infusion, into the stomach. Its odorous emanations readily excite a copious flow of tears. On the general system it operates as a stimulant, and promotes the secretion of urine and perspiration.

USES.—Scraped in shreds, it is used at the table as a condimentary accompaniment to roast beef. It is not much employed as a medicine. Chewed, it serves as an excellent masticatory. Taken in this way, or in the form of syrup, it may be serviceable in some forms of hoarseness. An infusion of it may be taken to excite vomiting, or to promote the operation of other emetics, as in poisoning by narcotic substances. As a general stimulant, diaphoretic, and diuretic, it has been used in palsy, chronic rheumatism, and dropsy. It is one of the remedies deemed antiscorbutic.

ADMINISTRATION.—Dose, ʒss. or more, scraped into shreds.

1. INFUSUM ARMORACIÆ COMPOSITUM, L.; *Compound Infusion of Horse-radish.* —(Horse-radish, sliced; Mustard-seeds, bruised, of each ℥j.; Compound Spirit of Horse-radish, f j.; Boiling Distilled Water, Oj. Macerate the root and seeds in the water for two hours in a lightly covered vessel, and strain. Then add the compound spirit of Horse-radish.) — This preparation soon undergoes decomposition. It is stimulant and diuretic, and has been employed in chronic rheumatism, paralysis, dropsies, and scurvy.—Dose, f℥j. to f℥ij.

2. SPIRITUS ARMORACIÆ COMPOSITUS, L.; *Compound Spirit of Horse-radish.* (Horse-radish, sliced; Dried Orange Peel, of each ℥xx.; Nutmegs, bruised, ʒv.; Proof Spirit, *Cong.* j.; Water, Oij. Mix, and let a gallon distil, by a gentle heat.)—Usually employed as a stimulating adjunct to other medicines, especially to diuretic infusions.—Dose, fʒj. to fʒiv.

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[1] Gmelin, *Handb. d. Chem.* ii. 1248.

342. COCHLEARIA OFFICINALIS, *Linn.*—COMMON SCURVY-GRASS.

Sex. Syst. Tetradynamia Siliculosa.
(Herba.)

HISTORY.—This plant does not appear to have been known to the ancients.

BOTANY. **Gen. Char.**—See *Cochlearia Armoracia.*

Sp. Char.—*Silicules* ovate-globose, twice as short as their pedicels. Radical *leaves* stalked, cordate; cauline ones ovate dentate-angular (De Cand.)—*Annual.* *Stem* about a foot high. *Flowers* pure white.

Hab.—Indigenous; on the sea-coast, and in watering places on the Welsh and Scottish mountains. Cultivated in gardens.—Flowers in April and May.

DESCRIPTION.—Scurvy-grass (*herba cochleariæ*) evolves, when rubbed, a somewhat pungent odour. Its taste is penetrating and acrid.

COMPOSITION.—The *inspissated juice* was examined by Braconnot,[1] and the *fresh herb* by Gutret.[2] The latter obtained from it the following constituents:—*volatile oil, bitter resin, bitter extractive, gum, green fecula, vegetable albumen, hydrochlorate* and *sulphate of ammonia, nitrate* and *sulphate of lime.*

VOLATILE OIL (*Oleum Cochleariæ*).—This oil is identical with the oil of horse-radish (*ante*, p. 578).

PHYSIOLOGICAL EFFECTS AND USES.—A gentle stimulant, aperient, and diuretic. It has long been esteemed as an antiscorbutic.[3] It has also been used in visceral obstructions. It is occasionally eaten with bread and butter, like the water-cress. [Formerly introduced into the Dublin Pharmacopœia, now omitted.—ED.]

343. SINAPIS NIGRA, *Linn. L. E. D.*—COMMON OR BLACK MUSTARD.

Sex. Syst. Tetradynamia Siliquosa.
(Semen, *L.*—Flour of the seeds, generally mixed with those of Sinapis alba, and deprived of fixed oil by expression, *E.*—The flour of the seeds, *D.*)

HISTORY.—Mustard (νάπυ) was employed in medicine by Hippocrates.

BOTANY. **Gen. Char.**—*Silique* somewhat terete; the valves nerved. *Style* small, short, acute. *Seeds* in one row, somewhat globose. *Calyx* spreading (De Cand.)

Sp. Char.—*Siliques* smooth, even, somewhat tetragonal, pressed close

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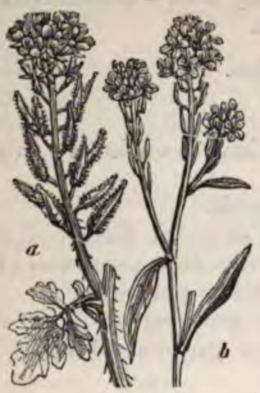
[1] *Journ. Phys.* lxxxiv. 278.
[2] Gmelin, *Handb. d. Chem.* ii. 1248.
[3] See Valentinus, *Cochlearia curiosa*, by Shirley, 1676.

FIG. 104.



a. Sinapis alba.
b. Sinapis nigra.

to the peduncle. Lower *leaves* lyrate; upper ones lanceolate, quite entire, stalked.—*Annual. Stem* 3 or 4 feet high. *Flowers* yellow.

Hab.—Indigenous; hedges and waste places. Cultivated in fields, especially in Durham and Yorkshire.

DESCRIPTION.—Black mustard seeds (*semina sinapis nigræ*) are small and roundish. Externally they are beautifully veined, and of a reddish or blackish-brown colour, though sometimes whitish. Internally they are yellow. They are inodorous, but have an acrid, bitter, oleaginous taste.

MANUFACTURE OF MUSTARD.—The following method of preparing *flour of mustard* (*farina sinapis*) was kindly furnished me by a manufacturer:—The seeds of both black and white mustard are first crushed between rollers, and then pounded in mortars. The pounded seeds are then sifted. The residue in the sieve is called *dressings* or *siftings:* what passes through is *impure flour of mustard.* The latter by a second sifting yields *pure flour of mustard,* and a second quantity of dressings. The *common flour of mustard* of the shops is adulterated with flour (wheaten), coloured by turmeric, and rendered hot by pod pepper. By pressure the dressings or siftings yield a fixed oil (*fixed oil of mustard*), which is used for mixing with rape and other oils. The whole seeds are never pressed. Mustard cake is employed as a manure, being too hot for cattle.

COMPOSITION.—Black mustard seed was analysed by Thibierge.[1] Some of its constituents have subsequently been examined by Henry fils and Garot;[2] by Pelouze;[3] by Robiquet and Boutron;[4] by Fauré;[5] by Simon;[6] by Bussy;[7] and by Bouton and Frémy.[8] From their labours we learn that black mustard seed contains *myronate of potash, myrosine, fixed oil, a pearly fatty matter, gummy matter, sugar, colouring matter, sinapisin, free acid, peculiar green matter, salts.*

1. MYRONIC ACID.—So called by Bussy, its discoverer, from *μύρον, an odorous oil.* It is an inodorous, non-volatile, bitter, non-crystallisable acid. It is soluble in water and alcohol, but not in ether. It is composed of *carbon, sulphur, hydrogen, nitrogen,* and *oxygen.* The alkaline myronates are crystallisable. Myronate of potash yields no precipitate with nitrate of silver, nitrate of baryta, acetate of lead, corrosive sublimate or chloride of calcium. The characteristic property of myronic acid is, to yield the *volatile oil of mustard* when mixed with myrosine and water. [This acid in mustard seed is combined with potash, forming myronate of potash, which is identical with the *sulpho-sinapisin* of Henry.—ED.]

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[1] *Journ. de Pharm.* v. 439.

[2] *Journ. de Chim. Méd.* i. 439 and 467; and *Journ. de Pharm.* xvii. 1.

[3] *Journ. de Chim. Méd.* vi. 577.

[4] *Journ. de Pharm.* xvii. 290.

[5] *Ibid.*

[6] *Ibid.* xxv. 366.

[7] *Ibid.* xxvi. 39.

[8] *Ibid.* p. 48.

MYROSINE; *Emulsin of Black Mustard.*—Bussy called it myrosine, from *μύρον*, *odorous oil*, and *συν*, *with*, because it yields, with myronic acid and water, the volatile oil of mustard. It has considerable resemblance to vegetable albumen and emulsin; but as it cannot be replaced by either of these substances, in the development of the volatile oil, it must be regarded as a substance *sui generis*. It is soluble in water; but is coagulated by heat, alcohol, and acids, and in this state it loses the power of acting on the myronates, and of yielding the volatile oil.

3. SINAPISINE.—This term has been given, by Simon, to a substance which he procured from *black* mustard seeds, and which he states possesses the following properties:—It presents itself in the form of white, brilliant, micaceous, volatile crystals, which are soluble in alcohol, ether, and the oils, but are insoluble in acids and alkalies. When mixed with the albumen (myrosine) of the mustard seed, it yields the volatile oil of mustard. Bussy ascribes this last property to myronic acid. It is highly improbable that two constituents of mustard should possess it. Analogy would lead us to suppose that the oil is generated by non-acid substances. Simon says sinapisine contains no sulphur. Myronic acid contains sulphur.

4. VOLATILE OR ESSENTIAL OIL OF MUSTARD ($C^8H^5NS^2$).—This does not pre-exist in the seeds; but is formed when water is added to the farina, by the mutual action of the contained myrosine and myronate of potash (sinapisine?), just as the volatile oil of bitter almonds is generated by the mutual action of emulsin, amygdalin, and water (see *ante*, p. 251). Alcohol extracts from the farina no volatile oil; but, by coagulating the myrosine, renders the farina incapable of developing the oil by the subsequent action of water. Sulphuric acid and the other mineral acids, as well as carbonate of potash, check the formation of the oil. But when the oil is once formed, the acids have no power to prevent its effects. Volatile oil of mustard is colourless or pale yellow; it has a most penetrating odour, and a most acrid and burning taste. Its sp. gr. at 68° F. is 1·015 (1·038). It boils at 290° F. It is slightly soluble in water, but readily so in alcohol and ether. By the action of ammonia on this oil, a white odourless, crystallisable substance called *Thiosinnamine* is produced,

$$[\underbrace{C_8H_5NS_2}_{\text{Oil of Mustard.}} + NH_3 \quad = \quad \underbrace{C_8H_8N_2S_2}_{\text{Thiosinnamine.}}]$$

These crystals are decomposed with the greatest facility by binoxide of mercury.[1] [Volatile oil of mustard is represented by the formula $C^8H^5NS^2$. According to Wertheim this oil is the sulphocyanide of *allyle* ($All=C^6H^5$). This is theoretically consistent with the constitution above given, for $C^6H^5C^2NS^9=C^8H^5NS^2=All,CyS^2$. —ED.][2] It is powerfully acrid, rubefacient, and vesicant. It has been proposed as a rubefacient in paralysis, and as a vesicant. The *distilled water of mustard* has been employed against the itch.[3]

5. FIXED OIL OF MUSTARD.—Usually procured from the dressings or siftings of mustard above referred to. It constitutes about 28 per cent. of the seeds. Its colour is reddish or brownish yellow. It has a faint odour of mustard, and a mild oily taste, It does not readily become rancid. It has been used as a purgative and anthelmintic.[4]

PHYSIOLOGICAL EFFECTS.—Mustard is an acrid stimulant belonging to the group of the *volatile pungent stimuli*. It holds an intermediate rank between horse-radish and pepper. Its topical action is that of a powerful acrid, and depends on the volatile oil developed by the action of water. The irritant operation, on the eyes, of the vapour arising from a mixture of hot water and flour of mustard, is familiarly known. Mustard cataplasms cause redness and burning pain, which, if the application be continued, becomes almost insupportable. A prolonged application causes vesication, with even ulceration and gangrene. Compared with those of cantharides, the topical effects of mustard on the skin sooner subside when the application is discontinued. When swallowed, mustard evinces the same stimulant operation on the stomach and bowels. Taken *in moderate quantities*, with the food, it promotes the appetite, and assists the assimilation of substances which are difficult of digestion. *In somewhat larger doses* (as one or two teaspoonfuls) it rouses the gastric susceptibility, and operates as an emetic. *In excessive quantities*, it gives rise to vomiting, purging, and gastro-enteritis. The effects of mustard on the general system are those of a stimulant. It quickens the pulse, and promotes the secretions (especially the urine) and the exhalations.

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[1] Robiquet and Bussy, *Journ. de Pharm.* xxvi. 119.

[2] [MM. Berthelot and De Luca have succeeded in producing this essential oil from glycerine and neutral fatty substances. See *Pharm. Journal*, vol. xv. p. 181.—ED.]

[3] Julia Fontenelle, *Journ. de Chim. Méd.* i. 131.

[4] Fontenelle, *op. supra cit.* 131.

Uses.—The *dietetical* uses of mustard are well known. It is well adapted for cold, phlegmatic individuals, with a torpid or atonic condition of the digestive organs. It is an excellent condimentary adjunct to heavy and difficultly digestible foods, as fatty matters.

As a *medicinal* agent, mustard is employed for several purposes. As an *emetic* it is useful where we want to rouse the gastric sensibility, as in narcotic poisoning, malignant cholera, and some forms of paralysis.[1] As a *stimulant* to the digestive organs it is applicable in atonic or torpid conditions of these parts, with dyspepsia, loss of appetite, and hepatic torpor. As a *diuretic* it has been employed with some benefit in dropsy.[2] As a *febrifuge* in intermittents, it has been employed either alone or in conjunction with cinchona.[3] But the principal use of mustard is as a *rubefacient* (see *Cataplasma Sinapis*). Flour of mustard, or bruised mustard seed, is sometimes added to pediluvia.

Administration.—As an *emetic*, the dose is from a teaspoonful to a tablespoonful of the flour of mustard in a tumblerful of water. As a *diuretic* in dropsies, and for some other purposes, *mustard whey* (*serum lactis sinapinum*) is a convenient form of exhibition. It is prepared by boiling half an ounce of the bruised seeds or powder in a pint of milk, and straining: the dose is f℥iv. twice or thrice a day.

CATAPLASMA SINAPIS, L.; *Sinapismus; Mustard Poultice* or *Sinapism.* (Linseed; Mustard-seed, of each, powdered, ℥iss.; Boiling Water, ℥xj. Add the powders, previously mixed, to the water by degrees, stirring so that a poultice be made.) Crumb of bread may be often conveniently substituted for linseed meal. Vinegar and other acids check the formation of the acrid oil. Boiling water also has an injurious effect. Hence water whose temperature does not exceed 100° F. is to be preferred for making the mustard poultice. Aetius[4] was acquainted with the injurious influence exercised by vinegar on mustard; and he observes,—"*Sed et hoc noscendum est: si in aceto maceretur sinapi inefficatus redditur: Acetum enim sinapis vim discutit.*" Several experiments on this subject have been made by Trousseau and Pidoux.[5] They found that a sinapism made with flour of black mustard and water produced as much effect in six minutes as one made with the flour of black mustard and vinegar did in fifty. Curiously enough, however, they state that vinegar did not diminish the activity of English flour of mustard. This, perhaps, is referable to the fact that common English flour of mustard contains pod pepper, the active principle (*capsicin*) of which is soluble in vinegar. The London College formerly ordered vinegar.—The mustard cataplasm is a powerful local irritant. It readily excites inflammation, and, when allowed to remain applied sufficiently long, causes vesication. It proves, in many cases, a most painful application. In various affections of the brain (as in the stupor and delirium of low fever, in apoplexy, and in poisoning by opium) it is a most valuable application to the feet and ankles. In pulmonary and cardiac diseases it is occasionally applied to the chest with excellent effects. Dr. Blackall[1] speaks in high terms of the mustard cataplasm, quickened with oil of turpentine, in typhoid pneumonia. Of course, in all these cases, it operates on the principle of a blister, over which its speedy effect gives it a great advantage. It is applied spread on linen or calico. Great caution is necessary in its application to persons who are insensible to pain; for if it be continued too long it may occasion ulceration and sloughing, though no pain be manifested. Hence its effects should be examined at short intervals. In one case death had nearly resulted from the neglect of this caution. Four sinapisms were applied to the wrists and insteps of a female lying in a comatose condition following puerperal convulsions. As no manifestation of pain occurred, the application continued for three hours. Sloughing followed, which nearly proved fatal.[2]

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[1] On the use of mustard emetics in cholera, see *Lond. Med. Gaz.* ix. 519, 592, and 795.

[2] Mead, *Works*, p. 514, 1762.

[3] Bergius, *Mat. Med.* 2d edit. ii. 618.

[4] *Sermo*, iii. cap. 181.

[5] *Traité de Thérap.* i. 692.

344. SINAPIS ALBA, *Linn. L. E. D.*—WHITE MUSTARD.

Sex. Syst. Tetradynamia Siliquosa.

(Semen, *L.*—Semina, *D.*—Flour of the seeds of Sinapis nigra, generally mixed with those of Sinapis alba, and deprived of fixed oil by expression, *E.*)

BOTANY. **Gen. Char.**—See *Sinapis Nigra.*

Sp. Char.—*Siliques* hispid, spreading, somewhat narrower than the ensiform beak. *Leaves* lyrate, and, as well as the *stem*, nearly smooth (De Cand.)

Annual. *Stem* 1 or 1½ foot high. *Flowers* large, yellow. *Beak* longer than the pod.

Hab.—Indigenous; in waste places. Cultivated in both fields and gardens. Flowers in June.

DESCRIPTION.—White mustard seeds (*semina sinapis albæ*) are larger and somewhat less acrid to the taste than the black ones. They consist of rounded-elliptical yellow grains, composed of yellow nucleus enveloped in a thin semi-transparent shell. The hilum is at one extremity of the ellipse.

COMPOSITION.—According to the analysis of John,[3] white mustard seeds consist of an *acrid volatile oil*, *yellow fatty oil*, *brown mild resin*,

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[1] *Observ. on Dropsies*, 4th edit. p. 339, 1824.
[2] Trousseau and Pidoux, *op. supra cit.* i. 700.
[3] Gmelin, *Handb. d. Chem.* ii. 1247.

extractive (very small quantity), *gum* (small quantity), *woody fibre*, *albumen*, *free phosphoric acid*, and *salts*.

Robiquet and Boutron,[1] however, have proved that white mustard contains neither volatile oil nor any substance capable of producing it; and that it owes its activity to *a non-volatile acrid substance* which does not pre-exist in the seeds, but is readily formed in them under certain conditions. Another chemical peculiarity of white mustard seed is, that it contains *sulpho-sinapisin*.[2] Hence, while sesquichloride of iron strikes a deep red colour in an infusion of white mustard, it merely communicates an orange tint to the infusion of black mustard. Moreover, the thick mucilaginous liquor obtained by digesting the seeds of white mustard in cold water is peculiar to them.[3] Simon[4] has announced the existence of a new principle, which he calls *erucin*.

1. SULPHOSINAPISIN.—It was at first supposed to be an acid, and was in consequence called, by Henry and Garot,[5] *sulphosinapic acid*. But they subsequently established its non-acid properties. It is a white, crystallisable, odourless, bitter substance, soluble in water, alcohol, and ether. Under the influence of various agents (acids, oxides, and salts) it readily yields hydrosulphocyanic acid. To this acid is probably to be ascribed the red colour developed when a persalt of iron is added to an aqueous infusion of white mustard. Its aqueous solution forms, with nitrate of silver, a white precipitate. Boutron and Frémy state that sinapisin [sulphosinapisin], under the influence of emulsin [myrosine], is converted into an acrid substance and hydrosulphocyanic acid. Sulphosinapisin consists of *carbon* 57·920, *hydrogen* 7·795, *nitrogen* 4·940, *sulphur* 9·657, and *oxygen* 19·688; or $C^{24}H^{22}NS^{2}O^{7}$.

2. NON-VOLATILE ACRID PRINCIPLE.—This does not pre-exist in white mustard, but is readily developed in it by cold water. As before mentioned, Boutron and Frémy[6] ascribe its formation to the action of the emulsin of the seed on the sulphosinapisin, by which hydrosulphocyanic acid and this acrid matter are produced. The latter substance is an unctuous, reddish, odourless liquid, which has the pungent hot taste of horse-radish. It contains sulphur as one of its constituents.

[From recent researches it appears that myrosine is contained both in black and white mustard; it is found to be precisely similar, and to possess similar properties, in the two varieties of seeds; but the products are different. Thus white mustard does not yield with myrosine and water the volatile oil of mustard, but a pungent oil of a different kind: hence it may be inferred that white mustard does not contain myronate of potash, but some other substance of an analogous kind. This different result on the two seeds is not owing to any peculiarity in the myrosine of white mustard, because when this is added to the residue of black mustard deprived of its myrosine, it yields the volatile oil, just as the emulsine of the sweet almond produces the essential oil of almonds on mixture with the amygdaline of the bitter almond and water. Myrosine acts on amygdaline like emulsine, but the latter cannot develope volatile oil of mustard by its action on myronate of potash. — ED.]

3. ERUCIN. — A yellowish-white substance, which is very soluble in ether, sulphide of carbon, and oil of turpentine. It dissolves in boiling alcohol, but is insoluble in water and solution of ammonia. It does not redden the salts of iron, and contains no sulphur.

PHYSIOLOGICAL EFFECTS.—Similar to, though milder than, those produced by black mustard. Swallowed whole, the seeds prove stomachic, laxative, and diuretic. But their use in the large quantities in which they have been recommended is by no means free from danger. Gastro-enteritic inflammation of a fatal kind has been induced by them. The danger of their accumulation in the appendix cæci is obvious. Mr. J. L. Wheeler[1] has known them retained in the bowels for seven weeks.

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[1] *Journ. de Pharm.* xvii. p. 279.

[2] Henry and Garot, *Journ. de Chim. Méd.* i. 441.

[3] Cadet, *Journ. de Pharm.* xiii. 191.

[4] *Journ. de Pharm.* xxv. 370.

[5] *Journ. de Chim. Méd.* i. 439.

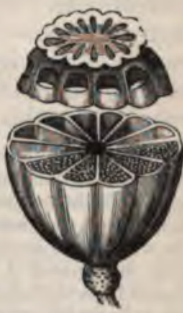
[6] *Journ. de Pharm.* xxvi. 50.

USES.—Dr. Cullen[2] first mentions the practice of giving half an ounce, or an ordinary tablespoonful, of entire and unbruised mustard seeds. A few years ago it was again brought forward, as if new.[3] It has been advocated in a long list of diseases attended with torpor or atony of the digestive organs; and at one time it was fashionable and popular. Sir John Sinclair[4] recommended mustard seeds for the preservation of the health of old people especially. The seed-leaves of white mustard and of *Lepidium sativum* are used at table under the name of *mustard and cress* or *corn salad.*

ADMINISTRATION.—From two or three large teaspoonfuls to a tablespoonful of the whole unbruised seed have been recommended to be swallowed three or four times daily.

ORDER LXXXIV. PAPAVERACEÆ, *Jussieu*.—THE POPPY TRIBE.

FIG. 105.



Capsule of the Poppy.

CHARACTERS.—*Sepals* 2, deciduous. *Petals* hypogynous, either 4 or some multiple of that number, placed in a cruciate manner. *Stamens* hypogynous, either 8, or some multiple of 4, generally very numerous, often in four parcels, one of which adheres to the base of each petal; *anthers* 2-celled innate. *Ovary* solitary; *style* short or none, *stigmas* alternate with the placentæ, 2 or many; in the latter case stellate upon the flat apex of the ovary. *Fruit* 1-celled, either pod-shaped, with two parietal placentæ, or capsular, with several placentæ. *Seeds* numerous; *albumen* between fleshy and oily; *embryo* minute, straight at the base of the albumen, with plano-convex *cotyledons*.—*Herbaceous* plants or *shrubs*, with a milky juice. *Leaves* alternate, more or less divided. *Peduncles* long 1-flowered; *flowers* never blue (Lindley).

PROPERTIES.—The plants of this order possess narcotic and acrid properties. At the head of the narcotic papaveraceæ stands the genus *Papaver*, from which opium is procured. The acrid papaveraceæ usually possess narcotic properties also. *Sanguinaria canadensis* is one of the best known acronarcotics of this order.[5] In doses of from ten to twenty grains it operates as an emetic. In larger doses it causes depression of pulse, faintness, dimness of vision, and alarming prostration of strength. Its active principle is an alkali called *sanguinarina.* *Chelidonium majus* is another acrid of this order.

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[1] *Cat. Rat. Plant. Med.* Lond. 1830.

[2] *Mat. Med.* ii. 171.

[3] C. T. Cooke, *Obs. on the Efficacy of White Mustard-seed*, 3d ed. 1826.

[4] *Lancet*, Jan. 25th, 1834, p. 669.

[5] Bird, *An Inaug. Dissert. on Sang. canad.* New York, 1822.

345. PAPAVER RHŒAS, *Linn. L. E. D.*—COMMON RED OR CORN POPPY.

Sex. Syst. Polyandria Monogynia.
(Petalum recens, *L.*—Petals, *E. D.*)

HISTORY.—Theophrastus[1] calls the red poppy ῥοιὰς. Dr. Sibthorp[2] considers the μήκων ῥοιὰς of Dioscorides[3] to be the red poppy.

BOTANY. **Gen. Char.**—*Sepals* 2, convex, deciduous. *Petals* 4. *Stamens* numerous. *Style* 0. *Stigmas* 4 to 20, radiating, sessile upon the disk crowning the ovary. *Capsule* obovate, 1-celled, composed of from 4 to 20 carpels enclosed in a membranous production of the thalamus, dehiscing by short valves under the crown of the stigmas. *Placentæ* between the valves, produced internally, forming complete dissepiments (De Cand.)—*Herbs*, with a white juice. *Peduncles* inflexed at the apex before flowering.

Sp. Char.—*Capsule* smooth, obovate. *Sepals* hairy. *Stem* many-flowered, rough, with spreading setæ. *Leaves* pinnatipartite; lobes elongated, incised-dentate, acute (De Cand.)

Annual. *Petals* rich scarlet. This plant is distinguished from Papaver dubium by, 1st, the wide-spreading hairs of the flower-stalks; 2ndly, a shorter capsule; 3rdly, its stigma of eight to ten rays.

Hab.—Indigenous. A troublesome weed common in fields. Flowers in June or July.

DESCRIPTION.—The petals of the red poppy (*petala rhœados seu papaveris erratici*) have a rich scarlet colour, a slightly opiate odour, and a bitterish taste. By drying they become violet red and odourless.

COMPOSITION.—The flowers of the red poppy have been analysed by Beetz and Ludewig,[4] and by Riffard.[5] The latter chemist obtained *yellow fatty matter* 12, *red-colouring matter* 40, *gum* 20, *lignin* 28. It is not improbable that this plant may contain *morphia* in very minute quantity.

RED COLOURING MATTER.—Riffard obtained it, in the impure state, by first macerating the petals in ether to remove a fatty matter, and then in alcohol. By distilling the alcoholic tincture to dryness, a dark-red colouring matter was obtained, which in thin layers was bright red. It was deliquescent in the air, soluble in alcohol and in water, but insoluble in ether. Acids diminished the intensity of its colour. Chlorine decolorised it. The alkalies blackened it. By the last character it is distinguished from the colouring matter of the red cabbage, &c., which becomes green by alkalies. Sesquichloride of iron gives it a dark violet or brown tinge.

PHYSIOLOGICAL EFFECTS AND USES.—The red poppy is valued medicinally as a colouring ingredient only. It probably possesses a narcotic property in a very slight degree, but which is scarcely sensible in the ordinary doses in which this medicine is employed. Navier[6] says that the continued use of the tincture or syrup by dogs gave the stomach a bluish-red tinge.

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[1] *Hist. Plant.* ix. 13.
[2] *Prodr. Fl. Græc.* i. 359.
[3] Lib. iv. cap. 64.
[4] Gmelin, *Handb. d. Chem.* ii. 1246.
[5] *Journ. d. Pharm.* xii. 412.
[6] Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iv. S. 47.

SYRUPUS RHŒADOS, L. E.; *Syrup of Red Poppies; Syrup of Corn Poppy.* (Of the Red Poppy, lb. j.: Boiling distilled Water, Oj.; Sugar lb. iij., or a sufficiency; Rectified Spirit, ℥iiss. or a sufficiency. Add the red poppy gradually to the water heated in a water-bath [vapour-bath, *E.*], frequently stirring them; then, the vessels being removed, macerate for twelve hours; afterwards [strain and, *E.*] express the liquor by hand [through calico, *E.*], and [proceed as ordered for the Syrupus Althææ, *L.*] [add the sugar and dissolve with the aid of heat, *E.*])—Employed only as a colouring ingredient, especially in conjunction with acids, which brighten it. It readily ferments and spoils.

346. PAPAVER SOMNIFERUM, *Linn. L. E. D.*—THE SOMNIFEROUS OR WHITE POPPY.

Sex. Syst. Polyandria Monogynia.

(Capsulæ maturæ; Capsulæ immaturæ succus concretus, *L.*—Capsules not quite ripe; Concrete juice from the unripe capsules, *E.*—Capsularum succus proprius concretus; Capsulæ maturæ, *D.*)

HISTORY.—This is one of the most anciently known and described plants. Homer speaks of the *poppy* (*μήκον*) growing in gardens;[1] so that it appears to have been in cultivation even at that early period. It was employed in medicine by Hippocrates, and is mentioned by Theophrastus, Dioscorides, and Pliny. Hippocrates[2] speaks of two kinds—the *black* and *white poppy:* the former, he says, confines the bowels more than the latter.

It is uncertain at what period *opium* was first known or introduced into medicine. Hippocrates[3] recommends the *μηκώνιον*, or *poppy juice,* in a disease of the uterus; and Dioscorides,[4] on the authority of Erasistratus, tells us that Diagoras (who was contemporary, it is supposed, with Hippocrates) condemned the use of opium. These are, I believe, the most ancient Greek authorities who speak of this substance; and it is impossible, I think, to arrive at any accurate conclusion from their remarks, whether opium had or had not been known long before their time, though Alston[5] infers, from the little use made of it by Hippocrates, as well as from Diagoras condemning its use in diseases of the eyes, that its virtues were not known long before him. Dioscorides and Pliny[6] mention that the expressed juice of the heads and leaves is termed *Meconium,* and that it is much weaker than opium. Theodore Zwinger, Sprengel,[7] and others, have supposed that the *nepenthes* (*νηπενθές*) of Homer[8] was opium. Dr. Royle,[9] however, has suggested that the substance referred to by Homer may have been a preparation of *Cannabis sativa*, the remarkable effects of which have been pointed out by Dr. O'Shaughnessy.[1]

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[1] *Il.* viii. 306.

[2] *De vict. rat.* lib. ii. p. 357, ed. Fœs.

[3] *De Morb. Mul.* lib. ii. p. 670.

[4] Lib. iv. cap. 65.

[5] *Lect. on the Mat. Med.* ii. 456.

[6] *Hist. Nat.* lib. xx. cap. 76, ed. Valp.

[7] *Hist. Rei Herb.* i. 25.

[8] *Od.* iv. 220.

[9] *Illustr.* p. 334.

The word *opium* is derived from ὀπὸς, *the juice*, and signifies that it is *the juice* par excellence;—just as the flower of the rosemary has been called *anthos*, or *the flower*,—and the cortex cinchonæ, *the bark*.

BOTANY. **Gen. Char.**—See *Papaver Rhœas*.

Sp. Char.—*Capsules* obovate or globose, and, as well as the *calyces*, smooth. *Stem* smooth, glaucous. *Leaves* amplexicaul, cut-repand, dentate, somewhat obtuse (De Cand.)

An annual *herb*. *Root* white, tapering. *Stem* 2 to 6 feet high, erect, branched, leafy, glaucous green. *Leaves* alternate, sessile, ovate-oblong, glaucous beneath. *Peduncles* terminal, leafless, with bristly hairs. *Seeds* numerous, small, roundish or reniform, oily, sweet, and edible.

There are two well-marked varieties, which, by some botanists, are considered to be distinct species:—

α. *nigrum;* P. somniferum, Gmelin.—*Capsules* globose, opening by foramina under the stigma. *Seeds* black.[2] *Peduncles* many. *Flowers* usually violet or red, of different tints, though sometimes white.

β. *album;* P. officinale, Gmelin.—*Capsules* ovate-globose; foramina under the stigma either none or obliterated. *Peduncles* solitary. *Seeds* and *petals* white.

Hab.—Asia and Egypt. Grows apparently wild in some parts of England, but has probably escaped from gardens. Cultivated in Hindostan, Persia, Asia Minor, and Egypt, on account of the opium obtained from it. According to Dr. Royle, var. *β album* is cultivated in the plains of India; and var. *α nigrum* in the Himalayas. In Europe the poppy is cultivated for the capsules, either as medicinal agents or for the oil (*poppy oil*) obtained from the seeds, and which is employed in painting. The London market is principally supplied with poppy heads from the neighbourhood of Mitcham, in Surrey.

DESCRIPTION. 1. OF POPPY HEADS.—Poppy heads (*Capsulæ seu Capita Papaveris*) are usually collected when quite ripe, as ordered by the London and Dublin Colleges, but they would be more active as medicinal agents if they were gathered while still green; and the Edinburgh College very properly directs the immature capsule to be employed. As met with in commerce, poppy heads vary somewhat in size, from that of a hen's egg to that of the fist. Their texture is papyraceous: on the top of them is the star-like stigma. They are yellowish or yellowish-brown, and, if they have been collected before they were quite ripe, have a bitterish taste. When fresh, they have a slightly opiate odour, which they lose by drying. A decoction of the dried poppy capsule is rendered, by the sesquichloride of iron, brownish red (*meconate of iron*). Nitric acid makes the decoction transparent, and communicates a slightly orange-red tinge, indicative of the presence of morphia.

2. OPIUM. *PREPARATION.*—The mode of extracting opium is, to a certain extent, similar in all countries, and consists in making incisions

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[1] *On the Prepar. of the Indian Hemp*, Calcutta, 1839.

[2] [*Maw seed* is the seed of a variety of garden poppy (Papaver somniferum). The seeds have a greyish blue colour; they are eagerly eaten by birds, and are used as a medicine for them.—ED.]

into the half-ripe poppy capsules, and collecting the exuded juice. According to Dioscorides,[1] Kæmpfer,[2] Kerr,[3] and Texier, this juice is worked up into a homogeneous mass: whereas Bellonius[4] and Olivier[5] speak of the juice concreting on the poppy; and the first of these writers describes opium as consisting of agglomerated granules. Guibourt,[6] by examining the opiums of commerce by means of a magnifier, thinks he has discovered that the Smyrna and Persian (or Trebizond) opium is composed of small agglutinated tears (*opium with a grain*); whereas the Egyptian, and I would add the Indian, opium, is a homogeneous mass, and therefore must have been worked up in the manner described by Dioscorides, Kæmpfer, and others (*homogeneous opium*).

[The most complete history of the cultivation and preparation of opium in our Indian possessions has been published by Dr. Eatwell. An abstract of his paper was inserted in the eleventh and twelfth volumes of the Pharmaceutical Journal for 1852. We have selected from this such portions as appeared to possess any interest in reference to the history of this most important article of Materia Medica.—ED.]

Bengal opium district.—The cultivation of the poppy in British India is confined to the large central Gangetic tract, about six hundred miles in length, and two hundred miles in depth, which is bounded on the north by Goruckpore, on the south by Hazareebaugh, on the east by Dingepore, and on the west by Agra. This large extent of country is divided into two agencies, the Behar, and the Benares, the former being presided over by an agent stationed at Patna, at which station is the central or sudder factory of the agency, the latter being under the control of an agent residing at Ghazeepore, which station contains the sudder factory of the Benares agency. Finally, the control of the entire department is vested in the Board of Customs, Salt, and Opium, located in Calcutta. Of the two agencies, the Behar is the larger and more important, sending to the market about treble the quantity of drug turned out by the Benares agency. The Benares agency comprises eight divisions, namely, the Benares and Mirzapore, the Ghazeepore, the Azinghur, the Juanpore, the Selimpore, the Goruckpore, the Cawnpore, and the Futtehpore. In these eight divisions, the aggregate amount of land under poppy cultivation, in the season 1849-50, was 1,07,823 beeghas.[7]

Influence of soil and climate on production.—The *lands* selected for poppy cultivation are generally situated in the vicinity of villages where the facilities for manuring and irrigation are greatest. In such situations, and when the soil is rich, it is frequently the practice with the cultivators to take a crop of Indian corn, maize, or vegetables, off the ground during the rainy season, and after the removal of this in September, to dress and manure the ground for the subsequent poppy sowings. In other situations, however, and when the soil is not rich, the poppy crop is the only one taken off the ground during the year, and from the commencement of the rains in June or July until October, the ground is dressed and cleaned by successive ploughings and weedings, and manured to the extent which the means of the cultivator will permit. In the final preparation of the land in October and November, the soil, after being well loosened and turned up by the plough, is crushed and broken down by the passage of a heavy log of wood over its surface, and it is in this state ready for sowing. The amount of produce from various lands differs considerably. Under very favourable circumstances of soil and season as much as 12 or even 13 seers (26 lbs.) of standard opium may be obtained from each beegha of 27,225 square feet. Under less favourable conditions the out-turn may not exceed three or four seers, but the usual amount of produce varies from 6 to 8 seers per beegha.

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[1] Lib. iv. cap. 64.
[2] *Amæn. Exot.* p. 643.
[3] *Med. Obs. and Inq.* vol. v. p. 317.
[4] *Observ.* lib. iii. cap. 15.
[5] *Voy. dans l'Empire Ottoman.*
[6] *Hist. abrég.* ii. 3me. éd. 1836.
[7] A Beegah is 27,225 square feet.

The chemical examination of different *soils* in connection with their opium-producing powers presents a field for very profitable and interesting inquiry; nor is the least important part of the investigation that which has reference to the variations in the proportions of the alkaloids (especially the morphia and narcotine) which occur in opium produced in various localities. That atmospheric causes exert a certain influence in determining these variations is probable: that they influence the *amount* of produce and cause alterations in the *physical* appearance of the drug are facts well known to every cultivator. Thus the effect of dews is to facilitate the flow of the juice from the wounded capsule, rendering it abundant in quantity, but causing it at the same time to be dark and liquid. An easterly wind (which in this part of the country is always concomitant with a damp state of atmosphere) retards the flow of the juice, and renders it dark and liquid. A moderate westerly wind, with dew at night, forms the atmospheric conditions most favourable for collections, both as regards the quantity and the quality of the exudation. If, however, the westerly wind (which is an extremely dry wind) blow violently, the exudation from the capsules is sparing. Whilst the effects of the meteorological phenomena in producing the above results are well marked, their action in altering the relative proportions of the chemical constituents of the juice of the poppy plant is more obscure; and it is highly probable that the chemical composition of the soil plays a most important part in this respect. Dr. O'Shaughnessy is certainly the most accomplished chemist who has ever in India turned his attention to the subject, and he has published the results of his analysis of specimens of opium from the different divisions of the Behar agency, which are worthy of much attention. In the opium from eight divisions of the agency, he found the quantity of morphia to range from 1¾ grains to 3½ grains per cent., and the amount of the narcotine to vary from ¾ grain to 3½ grains per cent., the consistence of the various specimens being between 75 and 79 per cent. In the opium from the Hazareebaugh district (the consistence of the drug being 77) he found 4½ per cent. of morphia and 4 per cent. of narcotine, whilst from a specimen of Patna garden opium he extracted no less than 10¾ per cent. of morphia and 6 per cent. of narcotine, the consistence of the drug being 87. With respect to this last specimen, Dr. O'Shaughnessy mentions that the poppies which produced it were irrigated three times during the season, and that no manure was employed upon the soil. It is much to be regretted that these interesting results were not coupled with an analysis of the soils from which the specimens were produced, for to chemical variations in it must be attributed the widely different results recorded above. The climate in which the Patna garden opium was produced (which is equal in narcotic excellence to the best opium of Turkey or Egypt) was precisely the same as that in which the comparatively poor specimens of the eight divisions above alluded to were collected, and therefore could not have exerted any influence in producing the chemical differences which the drug from the different localities presented.

Cultivation.—The poppy cultivated in the Benares and Behar agencies is exclusively the white variety (papaver somniferum album). In situations favourable to its growth, it vegetates luxuriantly, attaining usually a height of about four feet. The stem is branched, and is terminated by from two to five ovate-globose capsules, averaging in size a duck's egg. The plant takes about three months and a half in reaching maturity, and the time for its cultivation is exclusively the cold season, extending from November to March. It has been found advantageous to change the seed employed in the different divisions every two or three years, and there are certain districts which produce seed of generally acknowledged superiority, and from which the supplies are therefore drawn, and distributed to the cultivators of distant agencies. The soil having been prepared in the manner described above, the sowing is effected by throwing the seed broad-cast over the land, and this takes place between the 1st and 15th of November. In three or four days the plough is again passed over the land to bury the seed; and the soil is afterwards again levelled by means of the log of wood before alluded to. The whole surface is then divided into square compartments, the sides of which are about ten feet in length, and are raised and converted into little channels for the purpose of irrigation. The number of times the plant may require irrigation depends in a great measure upon the nature of the season; if some heavy showers fall in December, January, and February, two irrigations may be sufficient; whereas, if the cold season pass over with little or no rain, the operation may be required to be repeated five or six times. Ten or twelve days are sufficient for the germination of the seed, and after the little plants have attained the height of two or three inches they are carefully weeded and thinned.

In its progress towards maturity the poppy plant is liable to injury in various ways. It may be nipped by unusually severe frosts, or the plant may become stunted and never fairly reach maturity, owing to the first sowings failing and subsequent late ones being required, or owing to unusual heat and deficient moisture. Portions of cultivation sometimes droop and wither from causes which are not obvious, or are attacked by blight; and finally, considerable injury is frequently inflicted upon the poppy plants by a parasitical species of broom rape (the Orobanche indica) which attaching itself to the roots of the plants causes them to wither. In February the plant is generally in full flower, and towards the middle of the month, and just before the time for the fall of the petals, these latter are all carefully stripped off and collected. They are then formed into circular cakes from ten to fourteen inches in diameter, and about $\frac{1}{16}$ of an inch in thickness. The manner in which these leaf cakes are formed is the following: A circular shallow earthen vessel is heated to the requisite degree, by being placed inverted over a slow fire. A few petals are then spread upon its heated convex surface, and as soon as the glutinous juice which they contain is seen to exude, others are added to the moist surface and are pressed down by means of a cloth. As soon as these latter become moist in turn, they receive a similar addition of petals, and in this manner the cake is extended circularly by successive and continuous additions, until it has reached the required dimensions. Instead of the earthen vessel, a shallow or nearly flat iron cooking utensil is sometimes used. The cakes of petals (known in the department under the name of "leaves"), when they reach the sudder factory at Ghazeepore, are carefully sorted and separated into three classes, according to their size and colour. The smaller and dark-coloured "leaves" are used in forming the inner portions of the shells of the opium cakes, whilst the largest and least discoloured ones are kept for furnishing their outside coverings. In a few days after the removal of the petals the capsules have reached their utmost state of developement when the process of collection commences, which extends from about the 20th of February to the 25th of March.

Collection of the juice. — The mode of collecting the juice is the following: — At about three or four o'clock in the afternoon individuals repair to the fields and scarify the poppy capsules with sharp iron instruments called nushturs. The nushtur consists of four narrow bars of iron, each of which is about six inches in length, and of about the thickness of the blade of a penknife. At one extremity, each bar does not exceed a quarter of an inch in breadth; but it gradually expands, until it has acquired the breadth of about one inch at the opposite end, where it is deeply notched. The sides of the notch are somewhat curved and ground to sharp edges, and the external angles are brought to sharp points. The four little bars, being placed side by side, are bound firmly together by means of strong cotton thread; and the points, at their cutting extremities, are kept separated from each other, to the extent of about $\frac{1}{18}$ of an inch, by means of the cotton thread which is passed between each pair of contiguous blades. Thus prepared, the instrument presents four pairs of curved pointed, diverging blades, somewhat similar in shape to the lancet blades of a cupping scarificator. In employing the nushtur, only one set of points is brought into use at a time, and the capsule is scarified longitudinally from its base to its summit, the incisions generally passing more or less along one of the longitudinal eminences, observable on the outside of the capsule, which mark the attachment of the internal dissepiments. The scarifications thus made are very superficial, and do no more than traverse the thin pericarp of the capsule. If a horizontal section be made of the capsule of a vegetating poppy plant, the milky juice will after a few seconds be perceived to exude first and in greatest quantity from those portions of the sarcocarp which correspond to the bases of the dissepiments. It does not, however, exude only from these points, but ultimately from the entire surface of the cut sarcocarp. It moreover does not appear in dots as if poured out from longitudinal vessels, but exudes gradually from the meshes of the cellular tissue. If a thin segment of the capsule be examined under a high magnifying power, no longitudinal vessels are observable, but a confused mass of cellular tissue is observed occupying the interspace between the epicarp and endocarp, and opposite to the duplicatures of the endocarp, which go to form the dissepiments, the meshes of the cellular tissue are perceived to be much larger than in other situations: hence the free exudation of juice at these points. It therefore appears that the mode of making the scarifications as actually practised is the most effectual that could be adopted. Each capsule is scarified from two to six times, according to its dimensions; an interval of either two or three days being allowed after each operation.

The capsules having been scarified in the manner above described, the collection of the juice is made at an early hour on the following morning.[1] This is effected by means of instruments called seetooahs, which are made of sheet iron, and resemble concave trowels; and with these the juice is scraped from the surface of the scarifications, until the instruments become filled, when their contents are emptied into an earthen pot which the collector carries by his side. After the plant has ceased to yield any more juice, its utility is still unexhausted. The capsules are then collected, and from the seeds an oil is extracted, which is used by the natives for domestic purposes, both for burning in lamps and for certain culinary purposes. Of the entire seed a comfit is made, resembling in appearance caraway comfits. Of the dry cake remaining after the extraction of the oil, a coarse description of unleavened bread is sometimes prepared by the very indigent, or it is given to cattle, or used medicinally for poultices. The capsules, deprived of their seeds, are still available for preparing emollient and anodyne decoctions, which the natives use both internally in coughs, and externally as fomentations. The stems and leaves are left standing, until they have become perfectly dry, under the influence of the hot winds of April and May, when they are removed, and crushed and broken up into a coarse powder, known, in the department, under the name of "poppy trash," and which is employed in packing the opium cakes.

When fresh collected, the *juice* from the capsules presents the appearance of a wet granular mass, of a pinkish colour, and in the bottom of the vessel which contains it is found collected a dark fluid resembling infusion of coffee, to which the name of pussewah is given. The recent juice reddens strongly litmus paper, and acts rapidly upon metallic iron, covering it speedily with an inky crust of meconate of iron. The juice, when brought home by the cultivator, is placed in a shallow earthen vessel, which is tilted to such a degree, that all the pussewah can drain off; and this plan is persevered in so long as anything fluid will separate. The pussewah obtained by this means is set aside in a covered vessel, and receives no further attention until taken for weighment to the Ghazeepore sudder factory.

The opium now requires frequent attendance on the part of the cultivator. It is daily exposed to the air, though never to the sun, and is regularly turned over every few days, in order to insure an uniform dryage in the whole mass; and this process is persevered in for the space of three weeks or a month; or, in fact, until such time as the drug may have reached within a few degrees of standard consistence. Standard opium, according to the Benares regulations, is opium which, on being subjected to a temperature of 200° Fah. until everything volatile is driven off, shall leave a residue of 70 per cent. This is the consistence at which the agency puts up the drug for the market, every effort being made to adhere to it as strictly as possible, and this is likewise the standard by which the price paid to the cultivators is regulated. If the cultivator deliver his drug of standard consistence, he receives for it the regulated price: if it be above standard, he receives a pro rata increase of payment; whereas, if it be below standard, he is subjected to a corresponding deduction in price. The opium, on its arrival at the Ghazeepore factory, is turned out of the confined earthen pots in which it is received, and is weighed in wide tin vessels called tagars, care being taken that no larger quantity than 10 seers (20 lbs.) is ever brought to the scale at a time. This weighment is made under the eye of the gomashta (or of his accredited agent) of the kotee to which the opium belongs, and in the case of the neighbouring or "home" kotees the cultivators attend in person with their produce. This weighment is verified by a European officer stationed at a check-scale in another room, and the tagar with its contents passes on at once to a table at which are seated the opium examiner, or an experienced sub-deputy agent, and the native opium examiner, called the purkhea. The purkhea now plunges his hand into the centre and to the bottom of the drug, stirs it about, and grasps it in various directions to feel for impurities, and then withdraws a handful, which he manipulates between his fingers, revealing its colour, texture, and mode of fracture, and finally ascertains its aroma.

He then throws upon a plate a small portion as a specimen, and estimates its consistence. This estimate is written down on a ticket by the European officer, and it is sent with the specimen to the laboratory, where a fixed weight of drug is accurately weighed, evaporated to dryness in a plate placed on a metallic table heated by steam, and the weight of the residue carefully determined. It rarely happens that the purkhea's guess differs from the actual assay by more than one or two grains, and it serves to check the actual assay in cases of evident mistake or accident, which occasionally must occur when a multitude of delicate operations are rapidly carried on. The number of specimens which leave the examiner's table daily amounts to little short of two thousand. In the examination which the drug undergoes at this stage, the quantity of pussewah which it may contain is made the subject of special remark; and a pussewah fine or batta, as it is termed, is levied, proportionate to the quantity apparently present in the drug. The reason for this is, that pussewah injures the physical qualities of opium, causing it to look black and liquid, whilst at the same time it gives to the drug a high assay when tested by evaporation.

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[1] [This is similar to the mode of collecting opium in Asia Minor as described by Mr. Maltass. See *Pharmaceutical Journal*, vol. xiv. p. 395.—ED.]

Adulterations.—The *tactus eruditus* possessed by the purkhea is very remarkable; he rarely fails to detect even small quantities of the grosser and more tangible impurities, whilst he is no less delicately alive to the slightest variation in colour and smell. In the event of a specimen appearing to be adulterated, it is at once set aside to be carefully examined by the opium examiner, who makes a special report respecting it for the information of the agent, who, should he see sufficient grounds for doing so, confiscates it, when the whole of the drug is destroyed, and the cultivator gets nothing for it. Should the adulterations be less extensive, and the drug such as to be not altogether useless, it is taken at half price, or is subjected to such smaller penalty as the examining officer may think fit to inflict; and it is employed in making the lewah, or paste, used in forming the shells of the opium cakes. The great probability of detection, and the risk of confiscation, act as very efficient checks to the prevalence of adulteration, and the quantity of opium confiscated yearly is comparatively small. The nature of the adulterations practised by the cultivators is very various. The grosser impurities usually mixed with the drug to increase its weight are mud, sand, powdered charcoal, soot, cow-dung, pounded poppy petals, and pounded seeds of various descriptions. All of these substances are readily discoverable in breaking up the drug in cold water, removing the soluble and lighter portions of the diffused mass by decantation, and carefully examining the sediment. By this means impurities of the above nature usually become physically apparent. Flour is a very favourite article of adulteration, but is readily detected; opium so adulterated speedily becomes sour, it breaks with a peculiar short, ragged fracture, the sharp edges of which are dull, and not pink and translucent as they should be; and on squeezing a mass of the drug after immersion in water, the starch may be seen oozing from its surface. The application of the iodine test, however, furnishes conclusive evidence of its presence, or at least of that of some amylaceous compound. The farina of the boiled potato is not unfrequently made use of; ghee and goor (an impure treacle) are also occasionally used, as being articles at the command of most of the cultivators. Their presence is revealed by the peculiar odour and consistence which they impart to the drug. In addition to the above, a variety of vegetable juices, extracts, pulps, and colouring matters, are occasionally fraudulently mixed with the opium; such are the inspissated juice of the common prickly pear (Cactus dilenii), the extracts prepared from the tobacco plant (Nicotiana tabacum), the Datura stramonium, and the Indian hemp (Cannabis indica), &c. The gummy exudations from various plants are frequently used; and of pulps, the most frequently employed are those of the tamarind and of the Bael fruit (aegle marmelos). To impart colour to the drug, various substances are employed, as catechu, turmeric, the pounded flowers of the mowha tree (bassia latifolia), &c.

Tests of purity.—In the case of so complex a substance as opium, it is useless to look for a single test which shall reveal at once, with chemical precision, the purity of the drug; morphiometry would be the most accurate test to put in force, but the process would be too tedious and expensive to be of practical utility. Moreover, the colour, aroma, and texture are the commercial criterions of the excellence of the drug; and opium rich in morphia, but deficient in the above qualities from careless preparation, would probably be regarded with suspicion in the market, despite its intrinsic narcotic excellence; and for this reason, whenever the drug is received deficient in the above sensible qualities (as sometimes arises from careless treatment) but not adulterated in any way, it is subjected to a certain fine, and employed only in making lewah. The colour of well-prepared opium is a deep dull brown when viewed in mass, which becomes a bright chestnut brown when a small portion of drug is spread in a thin layer upon a white surface. It adheres to the fingers and draws out to a moderate extent, breaking with a short ragged fracture; should it, however, contain much pussewah, its ductility is much increased, and it is more glutinous.

Its smell is peculiar, and perfectly *sui generis:* it is not unpleasant, and in the recent well-prepared drug somewhat fruity. In cold water it breaks down readily into curdy flakes of the colour of pea-soup, which gradually subside, leaving the supernatant liquid of a deep brownish-yellow colour. When broken under water by the hand, the drug adheres moderately to the fingers at first, but is soon entirely diffused. Should it contain gum fraudulently mixed, this latter adheres pertinaciously to the hands, and is with difficulty removed; and in this manner I have frequently detected the presence of a substance similar to birdlime, probably the tenacious juice of the banyan tree (Ficus indica). If to a portion of the cold watery infusion in a test-tube, a few drops of a solution of diacetate of lead be added, a dirty grey precipitate (meconate of lead) falls, so copious as to equal nearly in bulk the amount of fluid in the tube. Ammonia throws down a very similar and almost equally abundant precipitate, composed of resin and the alkaloids, which, on exposure to the air, speedily assumes a black colour. Tincture of iodine throws down a brick-red precipitate, and tincture of sesquichloride of iron occasions a similar precipitate of somewhat darker colour. These tests may be applied in a few seconds, and the comparative bulk of the precipitates thrown down may enable us to form a rude estimate of the amount of opium contained in a given specimen. In very largely adulterated specimens, the evidence afforded by the above means is sufficiently marked. A solution of gelatine for the detection of tannic acid, and strong alcohol for the precipitation of gum, form the only other chemical reagents likely to be required.

Manufacture for exportation.—After having been duly weighed into store, the opium receives but little treatment in the factory. It is kept in large wooden boxes, capable of containing about 14 mds. (10 cwt.) each, in which it is (if below the manufacturing standard) occasionally stirred up from the bottom, until it has acquired the necessary consistence. Whilst remaining in these boxes it speedily becomes covered with a thin blackish crust (ulmine), and deepens in colour according to the amount of exposure to air and light which it undergoes. Should the drug be of very low consistence, it is placed in shallow wooden drawers, instead of in boxes, in which it is constantly turned over, until its consistence has approximated to 70 per cent. From the general store or malkhana the drug is exported daily in quantities equalling about 250 maunds, for the purpose of being manufactured or made up into balls or "*cakes*," as they are termed in the department. In exporting opium for this purpose, the officer who performs the duty selects for the most part opium which is exactly at standard, or very close to it, whilst to compensate for any drug which may have risen higher than the prescribed consistence, a certain proportion of opium of low consistence is exported, the consistences of the various proportions of drug selected for export being determined by a certain number of test assays. The portions of drug thus selected are then weighed out with exactitude, in portions of 10 seers (20 lbs.) each, and are thrown promiscuously into shallow wooden drawers, in which men mix them up together, rapidly and thoroughly thrusting their arms into the drug and kneading it in various directions. From these drawers the opium is transferred as mixed to boxes, all of which are of the same size, and from each of which a specimen is drawn and assayed. The mean of the assays of these boxes gives the average consistence of the export of the day, and serves as a guide as to whether the drug be of the proper consistence for caking. The above operations are generally completed by about 4 P.M., and before evening the drug is removed from the boxes to large wooden vats, 20 feet long, 3½ feet wide, and 1¼ feet deep, situated in the caking room. In these vats it undergoes a further kneading and admixture by men who wade knee-deep through the opium from one end of the vats to the other, until their contents appear to be of uniform consistence. Two specimens are, on the following morning, drawn from each vat, and assayed; and should the consistence have reached the factory standard, caking immediately commences.

Down either side of the room in which the vats are placed, are ranged the cake-makers, numbering usually about one hundred and ten individuals; each man being seated upon a wooden stand, and being furnished with a brass cup, forming the half of a hollow sphere, and with another tin vessel graduated so as to hold a determinate quantity of fluid. On the previous evening the leaves requisite for forming the shells of the cakes have been weighed out and tied up in bundles of prescribed weight, and have been damped to render them supple. Down the centre of the room are placed a certain number of small scales, at which the quantity of opium intended for each cake is separately weighed; and beside the scales are boxes filled with lewah, for the agglutination of the leaves which form the shells of the cakes. In forming the lewah, all opium of an inferior quality is used, and all the pussewah received is also employed for this purpose; but in addition to these, a considerable quantity of unexceptionable drug is also expended. These are broken down in the washings of the various pots and vessels which have contained opium, and a thin semi-fluid paste is formed of such a consistence that 100 grains of it, when evaporated to dryness at a temperature of 200° F., shall leave 53 grains of residue. Matters being thus arranged, the cake-maker receives in his graduated measure from the lewah box the prescribed quantity of lewah for making a single cake, and having by his side a bundle of leaves previously weighed, he rapidly forms in his brass cup the lower segment of the shell of the opium cake, pasting leaf over leaf, until the thickness of half an inch has been obtained, and allowing a certain free portion of the most external leaves to hang down all round over the sides of the brass cup. This accomplished, a boy is in waiting with the opium to be put into the cake, which he has just brought from the caking scales, and which he throws into the shell so far prepared to receive it. The cake-maker, holding the opium away from the sides of the shell with the left hand, then tucks in round the sides leaf after leaf, well smeared with lewah, imbricating one over the other, until he has completed the entire circle: the free edges of the leaves, which had hitherto hung over the sides of the cup, are now drawn up tightly, and the opium well compressed within its bag of leaves.

A small portion at the top now only remains, which is speedily closed by laying on leaf after leaf; and finally the work is completed by the application of a single large leaf, which covers the entire exposed half of the cake. As thus formed, the well-finished cake is a pretty regular sphere, not unlike, in size and appearance, a 24 lb. shot. It is now rolled in a little finely-powdered poppy trash, which adheres to its surface, is at once placed in a small earthen cup, of precisely the same dimensions as the brass mould in which it was made, and is carried out into the open air and exposed to the direct influence of the sun. It is so exposed for three days, during which time it is frequently turned and examined; and if (as is frequently the case) it should have become distended and puffy, it is at once torn open, the extricated gas allowed to escape, and the cake again tightly closed. On the evening of the third day it is placed (still contained in its cup) in the cake-frames, which are formed of open battens, and allow of a free circulation of air about the cakes. The average number of cakes made by a single man in one day is about 70; but there are cake-makers who will turn out as many as 90 or 100 cakes, between 9 A.M. and 3 P.M. The number of cakes made daily in the factory, during the manufacturing season, is from 6500 to 7000, and the total number of cakes manufactured in one season has been 426,800.

By the end of July the manufacturing is finished, but the cakes still require much attention; they are constantly turned over in their cups, and as mildew collects on their surfaces, it is removed by rolling and rubbing them in dry poppy trash. They are, moreover, individually examined, and those which present weak points are strengthened by the application of extra leaves; and their appearance is improved by the application of a single leaf of the first quality, which being of large dimensions, and carefully and equally made, covers the greater portion of the surface of the cake, and gives to it a smooth and finished appearance. By October the cakes have become perfectly dry to the touch, and have acquired considerable solidity; and they are now packed in chests, each of which is furnished with a double tier of wooden partitions, each tier presenting twenty square compartments, for the reception of so many cakes, and in which the cakes are steadied by means of loose poppy trash, with which all the interstices are filled.

Packing.—It might be supposed that so fragile a structure as the poppy petal would furnish but an insecure packing envelope; but the shells of the opium cakes are possessed of more resistance than might be imagined, and owing apparently to some antiseptic property in the lewah, they are capable (after once being thoroughly dried) of being preserved for a great length of time. For three or four months after manufacture the shells require constant care and attention; and even after being packed, any exposure to damp or moisture subjects them to injury. After a certain lapse of time, however, the opium contained in the cake ceases to yield any more moisture to the shell, and this latter acquires extreme solidity. There are three specimen cakes in the Ghazeepore factory which are some fifteen years old; they are as solid as balls of wood, and may be thrown from a height upon a stone floor without injury.

The above process of manufacture applies to the opium which is put up for the China market, and which includes the great bulk of the entire provision. With the drug intended for internal consumption, and called abkaree opium, a different process is followed. The opium intended for abkaree purposes is brought to a consistence of 90 per cent. by direct exposure to the sun, in which state it is as firm and as easily moulded as wax. It is then formed, by means of a mould, into square bricks of one seer weight each, and these are wrapped in oiled Nepaul paper, and packed in boxes furnished with compartments for their reception. The opium put up in this way has not the same powerful aroma as is possessed by that put up in balls; but this is its only deficiency, whilst it has the great advantage of containing a large amount of drug in a very limited space, and in a state very manageable for packing.

The manufacture for the season being finally concluded, six cakes are selected promiscuously from the provision, by the magistrate of Ghazeepore, for examination and chemical analysis. Of these, two are forwarded to the opium examiner at Calcutta, two to the examiner of the Behar agency, and two are reserved for examination by the examiner of the Benares agency.

The examination which these cakes undergo has reference to the following points:—

1. The gross weight of the cake.
2. The weight of the shell, detached as clearly as possible from the contained opium.
3. The weight of the opium contained in the shell.
4. The condition of the shell.
5. The physical character of the drug.
6. Its consistence.
7. The amount of extract taken up from it by cold distilled water.
8. The quantity of morphia present.
9. The quantity of narcotine present.

Chemical composition of recent juice.—A chief chemical feature which distinguishes Bengal opium from that of Turkey and Egypt, is the large proportion which the narcotine in the former bears to the morphia; and this proportion is shown by analysis to be constant in all seasons. It is a matter of importance to ascertain whether the treatment which the juice receives after collection can influence in any way the amount of the alkaloids, or of the other principles contained in opium. In Turkey, it is the custom to beat up the juice with saliva; in Malwa it is immersed as collected, in linseed oil; whilst in Bengal it is brought to the required consistence by mere exposure to the air in the shade, though at the same time all the watery part of the juice that will separate is drained off, and used, as has already been explained, in making lewah.

The following were the results obtained by Dr. Eatwell from the analysis of three samples of fresh juice, collected in February, 1850, and from which none of the pussewah was separated. The analyses have a special reference to the amount of the alkaloids, morphia and narcotine, present in the drug, no attempts having been made to separate any of the other principles in a state of purity. The samples are assumed to have been brought to a similar state of dryness by a heat not exceeding 200°.

	I.	II.	III.
Morphia	1·405	3·061	2·890
Narcotine	4·012	3·795	3·632
Matters soluble in alcohol	65·949	66·874	69·811
Dry marc insoluble in alcohol	28·506	26·301	23·665
Total	99·872	100·031	99·998

The agreement of the results in these three sets of experiments is tolerably close, except in the case of the drug subjected to analysis on the day of collection (I.), in which the quantity of morphia present is extremely small; but, as if to compensate for the deficiency to a certain amount, the quantity of narcotine present is larger than in either of the other two specimens. The suggestion which this arrangement naturally prompts is, whether it be possible that narcotine, by parting with a portion of its carbon, hydrogen, and oxygen, during the process of analysis, or during the changes which occur in the juice after its extraction from the plant, can be converted into morphia. The proposition is, however, quite speculative, and could only be satisfactorily demonstrated by a careful set of minute experiments, having reference to the proportions of all the principles entering into the composition of opium, at different periods, from the date of the extraction of the juice until the cessation of all fermentative action, which takes place until the drug has reached a certain degree of spissitude. The results of the second analysis are worthy of remark: they seem to indicate that the employment of artificial heat in bringing the drug rapidly to the required consistence is not detrimental to the narcotic excellence of the resulting opium; on the contrary, the experiment, so far as it goes, appears to indicate the very opposite result. It has already been stated that in preparing the drug the cultivators drain from it all the fluid portion, which of course consists of the *most soluble principles of opium, dissolved in dew, or in moisture absorbed from the atmosphere.* I now propose alluding more particularly to this fluid, to which the name of *pussewah* is given, and which is brought to the factory in large quantities, of many gallons at a time, and of all consistences, from that of a limpid fluid to that of thick treacle.

Constituents and properties of Pussewah.—Recently collected *pussewah* is a dark fluid, resembling strong infusion of coffee, and having a peculiar smell. It reddens litmus paper strongly; a solution of diacetate of lead causes in it a most copious grey precipitate (meconate of lead), and lime water has the same effect. Ammonia throws down a copious precipitate, of a mottled grey colour, which soon becomes uniformly black; and copious dilution with water likewise occasions in it a deep brown precipitate. Dr. Eatwell found the specific gravity of some recently collected pussewah to be 1·120, the temperature of the atmosphere being 83°; and 100 grains, on evaporation to dryness, were found to yield 30 grains of a brownish-yellow residue, emitting an odour somewhat resembling that of heated Burgundy pitch. After pussewah has become concentrated to about one-third of its original volume, it acquires the consistence of treacle; and, as the process of drying goes on still further, it gradually becomes solid. During the hot and dry months this solid residue acquires a resinous hardness, becoming brittle, and breaking with a resinous fracture; but as soon as the weather becomes damp it rapidly absorbs moisture from the atmosphere, becomes jetty black, and polished on the surface, and acquires a consistence similar to that of cobbler's wax. Pussewah (as might be supposed) contains some of the most valuable constituents of opium; its principal components are *meconic acid*, *resin*, *morphia*, and *narcotine*. From 500 grains of solid pussewah, which, on evaporation to dryness, left 88·9 grains of residue, Dr. Eatwell extracted 12 grains of pure narcotine, but only a trace of morphia. He, however, attributes this latter result to an accident in the analysis; as in a second analysis of 500 grains of solid pussewah, which, on evaporation, yielded 85·5 grains of residue, he obtained 10·6 grains of morphia, and 16·9 grains of narcotine. In order to form an idea of the precise extent to which the composition of Bengal opium is affected by the practice of draining from it the pussewah, it is requisite to ascertain, with some approach to accuracy, the quantity of pussewah usually furnished by a given amount of opium. The quantity of standard opium received at the sudder factory of the Benares agency during the season of 1849–50, was 18,191 maunds; whilst the quantity of pussewah delivered amounted to 100 maunds, being at the rate of one maund of pussewah to nearly 182 maunds of drug, the pussewah containing, on an average, say 50 per cent. of solid matter. This pussewah, be it observed, although separated from the drug, is not lost to the provision, being employed in the formation of the shells of the cakes; and, as the Chinese form a watery extract of the drug for the purpose of smoking, the whole of the constituents of the pussewah are thus recovered on boiling the shells in water, as is practised in China.

Vapours of the opium manufacture innoxious.—Amongst the thousands of individuals, cultivators and employés, with whom the factory is filled during the receiving and manufacturing seasons, no complaints are ever heard of any injurious effects resulting from the influence of the drug, whilst they all remain quite as free from general sickness as persons unconnected with the general establishment,—in fact, if anything, more so. It occasionally happens that a casual visitor to the factory complains of giddiness or headache, but the European officers employed in the department, who pass the greater part of the day with the thermometer between 95° and 105° Fah. amongst tons of the drug, never experience any bad effects from it. The native purkhea sits usually from six A.M. to three P.M. daily, with his hand and arm immersed nearly the whole time in the drug, which he is constantly smelling, and yet he feels no inconvenience from it. He has informed me that at the commencement of the season he experiences usually a sensation of numbness in the fingers; but I believe this to be more the result of fatigue, consequent upon the incessant use of the arm and fingers, than of any effect of the opium. In the large caking vats, men are employed to wade knee-deep through the drug for several hours during the morning, and they remain standing in it during the greater part of the rest of the day, serving out the opium by *armfuls*, their bodies being naked, with the exception of a cloth about the loins. These men complain of a sensation of drowsiness towards the end of their daily labours, and declare that they are overpowered early in the evening by sleep, but they do not complain of the effect as being either unpleasant or injurious. Infants, of a few months old, may be frequently seen lying on the opium-besmeared floor under the vats, in which dangerous position they are left by their thoughtless mothers: but, strange to say, without any accident ever occurring. Here are abundant facts to show that the health of those employed in the opium factory, and in the manipulation of the drug, is not exposed to any risk whatever, whilst the impunity with which the drug is handled, by hundreds of individuals, for hours together, proves that it has no endermic action, for I am inclined to consider the soporific effect experienced by the vat-treaders as produced through the lungs, and not through the skin.—Ed.]

Mr. Impey, alluding to the practice of collecting opium in Malwa, says:—"When the capsules crack and turn brown they are pulled off the stalks, and the seed shaken out: the heads are then thrown away. In poor districts, where the people cannot afford the indulgence and luxury of opium for smoking and chewing, the poppy heads are made into a decoction, and the liquid drunk in its stead. This liquid, from the Persian name of the capsule, is termed 'Post.' But another and more useful application of the capsules is also exercised: they are ground into fine powder, and, like the leaves, sold, under the name of *boosa*, to the retailers, and sprinkled over the *buttees* of opium, both to prevent their adhesion and to form a covering for them.

"The seeds are a very useful part of the plant, and very plentiful. From two to five maunds are procurable from a beegah, which obtains ready sale at 12 to 16 seers for a rupee: a very small quantity being required for seed, the rest is converted into oil, which, according to the native mode of expression, gives one-third in weight. According to Dr. O'Shaughnessy, it yields 56 per 100. It is of a pale yellow colour, clear, burns well, but is not adapted for lamps, on account of the smoke and smell which it gives out. The oil is very cheap, selling at eight seers per rupee; and the refuse is an extremely wholesome and nutritious food for cows, termed here *Khari*: it sells at the low rate of eight annas per maund. Lastly, the stalks, which might be made use of for fire-wood, are left in the ground untouched and unheeded."[1]

Description.—In commerce, several varieties of opium are known. The principal kind, however, is that brought from Smyrna.

1. **Smyrna Opium** (*Opium Smyrnæum*).—This is the *Turkey* or *Levant opium* of commerce. It occurs in irregular rounded or flattened masses of various sizes, rarely exceeding two lbs. in weight, enveloped in leaves, and usually surrounded with the reddish capsules of some species of *Rumex* (*R. orientalis*, according to Koch;[2] but *R. Patientia*, according to Merat).[3] Some of the flat cakes are without these capsules, and somewhat resemble Constantinople opium. When first imported, the masses are soft, and of a reddish brown colour; but, by keeping, they become hard and blackish. Its lustre is waxy; its odour is strong and unplea-

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[1] [From a paper by the author. *Pharmaceutical Journal*, Nov. 1851.—Ed.]

[2] T. W. C. Martius's *Pharmakogn.* S. 322.

[3] *Dict. Mat. Méd.* t. v. p. 50.

sant; its taste is bitter, acrid, nauseous, and persistent. M. Guibourt regards the masses as being made up of agglutinated tears, and on this account as being the purest met with. It is, however, frequently found largely adulterated. From one sample, weighing 10 ounces, I obtained 10 drachms of stone and gravel. Notwithstanding occasional frauds of this kind, Smyrna opium forms the best commercial opium. It yields more *morphia* and *meconic acid* than either Constantinople or Egyptian opium.[1] The quantity of *morphia* which can be obtained from it is, perhaps, on the average, about eight per cent. Pelletier,[2] in an operation on about two ounces of this opium, procured a quantity of morphia equal to 7·08 per cent. From a pound he calculates that eight or nine per cent. could be obtained. On an average, 12 per cent. of hydrochlorate of morphia may be procured from it. Dr. Christison obtained two drachms of *narcotine* from half a pound of the best Turkey opium: hence we may estimate the quantity at about four per cent. Hydrochlorate of morphia, prepared by Gregory's process from Turkey opium, contains, according to Dr. Gregory,[3] one-twelfth of codeia. Merck[4] examined five kinds of Smyrna opium: from the worst he procured 3 to 4 per cent. of morphia; from the best 13 to 13·5 per cent. In the latter variety he found 0·25 per cent. of codeia.[5]

[Mr. Evans has lately directed attention to a spurious kind of opium which, with all the external appearance of fine Turkey opium, and under that name, has recently been largely introduced into the market. It has given rise to great inconvenience, loss, and annoyance, from the fact of its being impossible to obtain a bright and clear solution of it. When used for the preparation of tincture, liquor, or extract, an opaque mucilaginous fluid is the result. Mr. Evans has carefully examined samples of this opium, and found very little pure opium in it, the great bulk of it consisting of an aqueous extract of the poppy mixed with some mucilaginous substance, having all the characters of Bassora gum. When triturated with water or spirit, this mucilaginous substance swells up, and becomes diffused through the fluid, but not dissolved, giving to it great opacity, which no amount of filtering will remove. He had been informed that, in Persia, an opium is prepared for home consumption after the genuine opium had been gathered, by boiling the plants and evaporating the decoction roughly to an extract. This extract is then mixed with a little opium, and well kneaded into balls—gum tragacanth, or any other gum, that may be at hand, or even flour, added to assist in their drying. There can be little doubt that this is the kind of opium which has found its way to the English market.[6]—ED.]

2. **Constantinople Opium** (*Opium Bizantinum* seu *Constantinopolitanum*). —I am indebted to Professor Guibourt for an authentic sample of this. His description of it is as follows: — "There are two sorts of it: one in

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[1] Berthemot, *Journ. de Pharm.* xxiv. 444.

[2] *Ibid.* xxi. 572.

[3] *Ibid.* xxi. 246.

[4] *Pharm. Central-Blatt für* 1836, S. 491.

[5] [Smyrna opium rasped, then mixed with common filtered water and allowed to remain in the liquor, yields a solution which powerfully retards the putrefaction of any animal matter placed therein. Dr. Pereira, in *Pharm. Journ.* vol. xi. p. 135.—ED.]

[6] [*Pharmaceutical Journal*, January, 1857, p. 359. —ED.]

very large irregular cakes, which are flattened like the Smyrna opium. This is of very good quality. The other is in small, flattened, regular cakes, of a lenticular form, from two to two and a half inches in diameter, and covered with a poppy leaf, the median nerves of which divide the disk into two parts. It has an odour similar to the preceding kind, but more feeble; it blackens and dries in the air. It is more mucilaginous than Smyrna opium." To this account I may add, that the cakes are never covered with the Rumex capsules, as those of Smyrna opium are. Berthemot describes two kinds of it; one soft, the other hard and brittle. Constantinople opium is inferior to the Smyrna kind, but superior to Egyptian opium. Professor Guibourt says that this kind of opium yields only half the morphia procurable from the Smyrna opium. Berthemot also states that though it yields more morphia than the Egyptian opium, it gives less than the Smyrna kind. This, however, does not agree with the experience of Mr. Duncan, of Edinburgh, who has never failed to obtain an extraordinary quantity of hydrochlorate of morphia from it. From an experiment of Dr. Christison's he calculates the quantity of hydrochlorate of morphia obtainable from it at 14 per cent.[1] Merck[2] procured 15 per cent. of pure morphia, but scarcely a trace of codeia. It is obvious, therefore, that Constantinople opium is of unequal quality. It is probable that opium of unequal qualities, and produced in several parts of the Turkish empire, is carried to the capital, and, being exported thence, bears the name of Constantinople opium.

3. **Egyptian Opium** (*Opium Ægyptiacum*).—It occurs in round flattened cakes of about three inches diameter, covered externally with the vestiges of some leaf. It is usually very dry. It is distinguished from the two preceding varieties by its reddish colour, analogous to that of Socotrine or hepatic aloes. Some very inferior qualities are sometimes offered for sale, and which appear to the sight and touch to be largely adulterated. By keeping, it does not blacken like the other kinds; its odour is less strong, and somewhat musty. Guibourt says, that by exposure to the air it becomes soft. Egyptian opium is, for the most part, inferior to either of the preceding kinds; but its quality is by no means uniform. Some kinds become damp by keeping. Guibourt tells us it yields only five-sevenths of the morphia obtained from Smyrna opium. Berthemot also states that it contains less morphia than either of the preceding kinds of opium, and that the morphia is more mixed with narcotine. He further adds, that the morphia which it yields is purified with great difficulty. The watery infusion of Egyptian opium has a distinct odour of acetic acid. Dr. Christison obtained about 10¼ per cent. of pure white hydrochlorate of morphia from it, which, he says, is about the quantity procured from good Turkey opium. Merck[3] procured only from 6 to 7 per cent. of morphia, but much meconic acid.

4. **Trebizond Opium** (*Persian Opium*).—Some years since a quantity of opium was imported into this country from Trebizond, in the form of cylindrical sticks, which, by pressure, have become somewhat angular.

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[1] *Journ. de Pharm.* xxi. 547.

[2] *Pharm. Central-Blatt für* 1836, S. 491.

[3] *Op. supra cit.*

Their length is about six inches; their diameter about half an inch, a little more or less. Each one is enveloped in a smooth shiny paper, and tied with cotton; its colour is similar to that of Socotrine aloes. It has the opiate odour stronger than that of the Egyptian kind, but less than Smyrna opium, and mixed somewhat with a musty odour; its taste is intensely bitter. It is commonly termed in commerce Persian opium, but the specimens I received came from Trebizond. It is an inferior kind. Merck[1] could obtain no morphia from it by the ordinary mode of proceeding. He, however, afterwards succeeded in obtaining about 1 per cent. It gave only a trace of narcotina. There must, I suspect, be some error in these statements, as this opium is certainly richer in morphia than is here stated.

5. **Indian Opium** (*Opium Indicum*).—Three varieties of Indian opium are known in commerce, viz.: —*Malwa*, *Benares*, and *Patna Opium*. As the two latter kinds are undistinguishable, I shall include them under one head of *Bengal Opium*.

α. *Bengal Opium* (*Benares* and *Patna Opium*).—Its preparation has been already fully described[2] (*ante*, p. 589).

Bengal opium is imported into this country in balls, each weighing about three lbs. and a half, and packed in chests, each containing about forty balls. The balls are hard, round like cannon-balls, and about the size of a child's head. Externally each ball is made of poppy petals, firmly agglutinated by a paste called *lewah*, to form a firm but laminated envelope weighing about 14 oz. On cutting through this, the opium is found to be quite soft, homogeneous, apparently quite pure, and to have the consistence of a soft extract. Its colour is blackish brown. Its odour and taste are strong, and purely opiate. On exposure to the air this opium speedily becomes covered with mouldiness. Both *Bahar* or *Patna* and *Benares Opium* are exported from Calcutta. Bahar and Benares are the only districts of Bengal where opium is produced. Benares, according to Dr. Butter, is most valued by the Chinese. The per-centage quantity of morphia and narcotina obtained by Dr. Eatwell from Bengal opium is elsewhere stated.[3] Dr. Smytten[4] procured only 2½ or 3 per cent. of morphia. From some experiments which I have made, I consider this quantity to be considerably below the truth. Mr. Morson informs me that Benares opium contains rather more than half the quantity of morphia contained in good average Turkey opium.

Garden Patna Opium.—For a sample of this opium I am indebted to Dr. Christison. It is imported in square cakes (enclosed in thin plates of mica), about three inches in length and breadth, and one inch thick. It has the appearance, as Professor Guibourt describes it, of a well-prepared, shiny, dry, pharmaceutical extract. Its colour is blackish brown. Its odour is less powerful than that of Smyrna opium. In the first edition of this work I described this kind of opium as *fine Malwa opium*. The following extract of a letter which I received from Dr. Christison will explain the cause of this error: — " The common ball opium of Patna and Benares (which are all but identical) was long known in India to be inferior in quality. During the inspectorship of Mr. Fleming, of Barrochan, he instituted inquiries, with his assistant Captain Jeremie, as to the causes of its inferiority, and, among other reasons, was led to suppose it owed its softness, tarriness, and general low quality, to the 'ryots' storing the juice in bottles till it accumulated to a sufficient extent to be made up, and to fermentation consequently taking place. Means were therefore taken to get this juice before being long kept, and it was made up into square cakes, of which I sent you one under the incorrect name of Malwa opium,—the name by which I got it." Mr. Fleming subsequently recognised the cakes in Dr. Christison's laboratory with his official stamp on them. Dr. Christison obtained 9·5 per cent. of muriate of morphia (snow white) from it, a considerable portion of narcotine, and so large a proportion as one-twelfth or 8 per cent. of codeia.

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[1] *Pharm. Central-Blatt für* 1836, S. 493.

[2] *On the Prepar. of Opium for the China Market*, in *Journ. Asiat. Soc. of Beng.* v. 165, 1836.

[3] See *ante*, p. 596.

[4] *Trans. of the Med. and Phys. Soc. of Calcutta*, vi.

This I presume is the opium employed by Merck[1] under the name of Bengal opium, and which, he says, was enclosed in plates of mica. In 100 parts he found *morphia* 8, *narcotine* 3, *codeia* 0·5, *thebaina* 1, *meconine* traces, and *porphyroxin* 0·5. Another sample of Indian opium, in round balls of half a pound each, and of the consistence of Calabrian extract of liquorice, yielded him 10 per cent. of morphia.[2]

β. *Malwa Opium.*—A few years since this ranked among the inferior kinds of Indian opium, but it has been gradually rising in value, and is now highly esteemed. I have received two varieties of opium under this denomination. They were brought to me from India by former pupils of mine. 1. One kind consists of a round flattened cake or ball, weighing ten ounces. It seems to have been packed in a coarse kind of dust, composed of broken poppy petals. Its consistence is about that of moderately firm Smyrna opium. When cut into, it presents a homogeneous texture. Its colour is dark brown; its odour similar to that of Smyrna opium. 2. The other kind (described in the first edition of this work as *inferior Malwa opium*) is in flattened cakes without any exterior covering. It is dull, opaque, blackish brown externally; internally somewhat darker and soft. Its odour is somewhat like that of Smyrna opium, but less powerful, and combined with a slight smoky smell. Guibourt says it yields as much extract as Levant opium; but its insoluble residue wants the vinous odour and glutinous consistence of the latter. It furnishes only one-third the quantity of morphia yielded by Smyrna opium. From common Malwa opium Dr. Smytten procured only from 3 to 5 per cent. of morphia; but, from fine samples, from 7¾ to 8 per cent.

Mr. E. Solly[3] states that he found "occasional minute cavities full of a pale yellow oil" in a specimen of Malwa opium. This opium yielded him 80 per cent. of soluble matter.

γ. *Cutch Opium.*—Under this name I have received from Bombay a small cake of opium, rather more than an inch in diameter, and apparently enveloped by the remnants of leaves. Its odour is much less powerful than that of Smyrna opium.

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[1] *Berl. Jahrb.* xxxvii. 289, 1837, and *Brit. Ann. of Med.* July 21, 1837.

[2] *Pharm. Central-Blatt für* 1836, 493.

[3] *Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society*, p. 141. Lond. 1841.

5. *Kandeish Opium.*—In round flattened cakes, weighing about half a pound each. It is nearly black, is hard, brittle, and presents a gritty or granular fracture. It yielded Mr. E. Solly[1] 72 per cent. of soluble matter, and about 7 per cent. of morphia.

6. **English Opium** (*Opium Anglicum*).—It is in flat cakes or balls, enveloped with leaves. It resembles fine Egyptian opium more than any other kind; its colour is that of hepatic aloes; it has a moderately strong opiate odour.[2] Mr. Hennell procured from 700 grains of English opium, prepared by Messrs. Cowley and Staines, 53 grains, or 7·57 per cent. of morphia; while from the same quantity of Turkey opium he obtained only 48 grains, or nearly 7 per cent. of morphia.[3] Mr. Morson,[4] from 20 oz. avoird. of the same British opium, procured only 384 grains, or about 4·4 per cent. of morphia, and 222 grains, or about 2·53 per cent. of narcotina. Probably the morphia obtained by Mr. Hennell was not freed from narcotina. Mr. Young states that British opium is stronger than the commercial opium; six ounces of the former being equal to eight of the latter.[5]

7. **French Opium** (*Opium Gallicum*). — I have not seen any samples of this. Pelletier[6] describes it as being of a deep reddish brown colour, and brittle when dry. Its taste was somewhat different to that of Smyrna opium. It left a less insoluble residuum than Eastern opium. Pelletier procured more *morphia* from it than from Smyrna opium. In an experiment on about two ounces of each, he obtained about 10·38 per cent. from the former, and only 7·08 per cent. from the latter. It contained no *narcotina.* He obtained sensible traces of *codeia,* but none of *narceine, meconine,* or *thebaina,* perhaps because the quantity of opium experimented on was too small. The disappearance of one immediate principle (narcotina), and the augmentation of another (morphia), caused by climate, are interesting facts. Petit[7] got from 16 to 18 per cent. of morphia; and Caventou (quoted by Christison) obtained from 22 to 28 per cent. from French opium; but I presume the morphia was very impure.

[The cultivation of French indigenous opium has been lately much improved by M. Aubergier. This gentleman proposes to call it *Affium.* He states that he has found the purple poppy (*pavot pourpre*) to yield an inspissated juice of the greatest uniformity of composition and strength. These conditions vary not only with the kind of poppy selected, but with the period at which the capsule is incised, and the time at which the juice is collected. Longitudinal incisions slightly inclined are made in the capsules when they are completely developed, and before they have passed from a green to a yellow colour. The incisions are made by four knife-blades, so mounted in a frame that the blades shall not penetrate to the interior of the capsule. The juice which exudes is immediately collected, and dried in the sun. The incisions are repeated at intervals, until the whole of the capsule is included. The opium thus obtained is found to yield pretty uniformly ten per cent. of morphia. M. Benard, in carrying out the plan of M. Aubergier, found that in six days 14,752 capsules were incised, and from them 431 grammes of milky juice were collected, which, by desiccation, yielded 205 grammes (=6·6 oz.) of opium. It is further stated that, on analysis, this opium yielded as much as 14·75 per cent. of morphia; while the commercial opium rarely yielded more than 8 or 9 per cent. From other calculations, it appears that the opium crop thus obtained is capable of yielding a good profit.[1] —ED.]

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[1] *Op. supra cit.*

[2] I must refer those interested in the cultivation of the poppy, and production of British opium, to the papers of Mr. Ball, in *Trans. Soc. of Arts,* xiv. 253; of Mr. Jones, *Ibid.* xviii. 161; of Mr. Young, *Ibid.* xxxvii. 23; of Messrs. Cowley and Staines, *Ibid.* xl. 9; and of the Rev. G. Swayne, *Quart. Journ.* vols. viii. and ix.

[3] *Trans. Soc. Arts,* xliii. 57.

[4] *Ibid.* l. 25.

[5] Duncan, *Suppl. to the Ed. Disp.* p. 81.

[6] *Journ. de Pharm.* xxi. 570.

[7] *Ibid.* xiii. 183.

8. **German Opium** (*Opium Germanicum*).—Biltz, of Erfurt, obtained from indigenous German opium 16½ and even 20 per cent. of *morphia*, where the opium had been procured from the *P. somniferum α. nigrum*; and between 6¼ and 9½ *narcotina*. But from opium made from *P. somniferum β. album* he got conversely 6·8 per cent. of morphia, and 33 per cent. of narcotina.

COMMERCE OF OPIUM.—The quantity of opium on which duty was paid during six years was as follows:[2]—

In 1834	27,253 lbs.	In 1838	30,824 lbs.
1835	30,398	1839	40,784
1836	38,553	1840	45,589
1837	36,833	1841	37,960

[In the year ending January 5th, 1853, the opium imported into this country amounted to 205,780 lbs., and of this there were exported 102,217 lbs., and retained for home consumption 62,521 lbs.—ED.]

Since August 13, 1836, the duty has been 1s. per lb.; previously to that and from 1828 it was 4s. per lb. Of the above quantities the greater part was imported from Turkey. The quantity of opium produced in Hindostan is enormous. In Patna and Benares its cultivation is a monopoly in the hands of government; and a revenue is derived from the Malwa opium, by a system of passes on shipment from Bombay. Of the whole quantity raised in Hindostan, it is calculated that about two-thirds have been sent to Canton, and the remainder to the Eastern Islands.[3] The following table is from Mr. R. Montgomery Martin's *Statistics of the Colonies of the British Empire*, Lond. 1839[4] (p. 366).

Estimate of Quantity and Total Value of Indian Opium consumed in China during the years ending in 1832-33.

Years.	*Patna.*	*Benares.*	*Malwa.*	*Total.*	
	Chests.	Chests.	Chests.	Chests (of one pecul. or about 133½ lbs. avoird.)	Amount in Spanish Dollars.
1827–28	4006	1128	4401	9535	10,425,075
1828-29	4831	1130	7171	13132	12,533,215
1829-30	5564	1579	6857	14000	12,057,157
1830-31	5085	1575	12100	18760	12,904,263
1831–32	4442	1518	8265	14225	11,501,584
1832–33	6410	1880	15403½	23693½	15,352,426

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[1] Bouchardat, *Annuaire de Thérapeutique*, 1855, pp. 4 and 12.

[2] *Trade List.*

[3] *Evid. taken before the Committee of the House of Lords on the Affairs of the East India Company*, No. 646, 1830, p. 25.

[4] [The revenue received by the East India Company from opium in the years 1854-5 amounted to £3,126,251. *Med. Times and Gazette*, March 7, 1857.—ED.]

All the world knows that these enormous quantities of opium were smuggled into China (by the connivance of the local authorities) for the purpose of smoking. The vessels anchored at Lintin, about 70 miles from Canton, and delivered the opium to the boats of the Chinese buyers. "Malwa opium is considered by the Chinese as having a higher touch, but not so mellow nor so pleasant in flavour as the Patna opium. The smokeable extract, which each quantity of opium contains, is thus intimated by the Chinese, — (who use opium as we do wine or spirits): — Patna and Benares opium 45 to 50 touch; average 48: Malwa 70 to 75; average 72½; Turkey 53 to 57: average touch 55."[1] The *smokeable extract* here referred to is an aqueous extract of opium prepared by the Chinese. A detail of the important events which have resulted from the active and extraordinary steps taken by this remarkable people to put a stop to the trade in opium, would be out of place in this work. Suffice it to say, that, in 1839, no less than 20,283 chests of opium, valued at nearly £3,000,000 sterling, were delivered up to the Chinese, and by them destroyed by immersing the opium in water with lime and salt, and, when the whole had become a fetid mud, allowing it to escape into the river.[2]

COMPOSITION. — Few substances have been so repeatedly submitted to chemical investigation as opium. The mere reference to the different labours which have been bestowed on it would occupy more space than I can devote to the subject. I must, therefore, content myself with brief notices of the most important epochs in its chemical history, and a reference to some of the analyses which have been made of it.

In 1803 Derosne[3] discovered *narcotina*. In 1804 Sertürner[4] announced the existence of *meconic acid* and *morphia*. Seguin[5] appears to have discovered them about the same time. Robiquet[6] confirmed these discoveries in 1814. In 1826 *meconine* was discovered by Dublanc jeune, and again in 1830 by Couerbe.[7] In 1832 Pelletier[8] discovered *narceina;* and, in the same year, Robiquet[9] announced the existence of *codeia*. In 1837 Merck[10] announced the existence, in opium, of a new substance, which he called *porphyroxin;* but his statement requires confirmation.

Analyses of opium have been published, in 1800 by Bucholz,[11] in 1804 by Sertürner, in 1814 by Seguin, in 1817 by Braconnot,[12] in 1818 by Buchner,[13] in 1819 by John,[14] in 1823 by Pfendler,[15] in 1824 by Lindbergson,[16] in 1826 by Merck,[17] in 1826 by Geiger,[18] in 1831 by Biltz,[19] in 1832 by Pelletier,[20] in 1834 by Schindler,[21] and in 1836 by Mulder.[22]

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[1] R. M. Martin, *op. supra cit.* p. 366.

[2] See *Asiatic Journal*, vol. xxx. part ii. p. 310; also *Parliamentary Reports on the Trade with China*, No. 359, 1840; and *Corresp. relating to China*, 1840.

[3] *Ann. de Chim.* xlv. 257.

[4] *Trommsdorff's Journ.* 1805, Bd. xiv. 1, S. 47.

[5] *Ann. de Chim.* xcii. 225; and *Ann. de Chim. et Phys.* ix. 282.

[6] *Ibid.* v. 275.

[7] *Ibid.* l. 337.

[8] *Ibid.* l. 262.

[9] *Ibid.* li. 259.

[10] *Pharm. Central-Blatt für* 1837, S. 342.

[11] *Trommsdorff's Journ.* viii. S. 24.

[12] *Journ. de Phys.* lxxxiv. 225.

[13] Quoted by Schwartze, *Pharm. Tab.*

[14] Gmelin, *Handb. d. Chem.* ii. 1244.

[15] Chem. *Abhandl. üb. d. Opium*, Wien, 1823.

[16] Gmelin, *op. supra cit.*

[17] *Ibid.*

[18] *Ibid.*

[19] *Pharm. Central-Blatt für* 1831, S. 757.

[20] *Ann. de Chim. et de Phys.* l. 240.

[21] *Pharm. Central-Blatt für* 1834, S. 754.

[22] *Ibid. für* 1837, S. 574.

Mulder's Analysis.	*Smyrna Opium.*				
	1	2	3	4	5
1. Morphia	10·842	4·106	9·852	2·842	3·800
2. Narcotina	6·808	8·150	9·360	7·702	6·546
3. Codeia....................	0·678	0·834	0·848	0·858	0·620
4. Narceine..................	6·662	7·506	7·684	9·902	13·240
5. Meconine..................	0·804	0·846	0·314	0·380	0·608
6. Meconic acid	5·124	3·968	7·620	7·252	6·644
7. Fat	2·166	1·350	1·816	4·204	1·508
8. Caoutchouc...............	6·012	5·026	3·674	3·754	3·206
9. Resin	3·582	2·028	4·112	2·208	1·834
10. Gummy extractive......	25·200	31·470	21·834	22·606	25·740
11. Gum	1·042	2·896	0·698	2·998	0·896
12. Mucus.....................	19·086	17·098	21·068	18·496	18·022
13. Water.....................	9·846	12·226	11·422	13·044	14·002
Loss	2·148	2·496	0·568	2·754	3·332
Smyrna opium ..	100·000	100·000	100·000	99·000	99·998

Schindler's Analyses.			
	Smyrna Opium.	*Constantinople Opium.*	*Egyptian Opium.*
Morphia	10·30	4·50	7·00
Narcotina......	1·30	3·47	2·68
Codeia	0·25	0·52	[90·32]
Narceine	0·71	0·42	
Meconine	0·08	0·30	
Meconic acid..	4·70	4·38	
Resin............	10·93	8·10	
Bassorin, caoutchouc, fat, and lignin	26·25	17·18	
Salts and volatile oil	3·60	3·60	
Lime and magnesia	0·47	0·42	
Alumina, oxide of iron, silica, & phosphate of lime	0·24	0·22	
Brown acid. soluble in alcohol and water	1·04	0·40	
Brown acid, soluble in water; gum and loss	40·13	56·49	
Total ...	100·00	100·00	100·00

Biltz's Analyses.			
	Oriental Opium.	*Indigenous Opium.*	
		From *a. nigrum.*	From *β. album.*
Morphia	9·25	20·00	6·85
Narcotina......	7·50	6·25	33·00
Meconic acid (impure).....	13·75	18·00	15·30
Bitter extractive............	22·00	8·50	11·00
Deposit.........	7·75	4·75	2·20
Albumen	20·00	17·50	13·00
Balsamic matter	6·25	7·65	6·80
Caoutchouc ...	2·00	10·50	4·50
Gum with lime	1·25	0·85	1·10
Sulphate of potash	2·00	2·25	2·00
Lime, iron, alumina & phosphoric acid..	1·50	1·85	1·15
Woody fibre ..	3·75	0·80	1·50
Ammonia, volatile oil, and loss	3·00	1·10	1·60
Total...	100·00	100·00	100·00

The following substances may be regarded as the constituents of opium: — *Morphia, narcotina, codeia, narceia, meconine, thebaina*, or *para-*

morphia, pseudomorphia?, meconic acid, brown acid extractive, sulphuric acid, resin, fat oil, gummy matter, caoutchouc, albumen, odorous principle (volatile oil?), and *lignin.*

1. Volatile Odorous Principles (*Volatile Oil?*).—The distilled water of opium has the peculiar odour of this drug, and by keeping deposits a ropy substance. Hitherto, however, all attempts to isolate the volatile odorous principle of opium have failed, and its nature, therefore, is as yet unknown. Nysten[1] swallowed two ounces of the distilled water without any sensible effect; and Orfila injected a like quantity of it into the jugular vein of a dog without apparently causing any inconvenience to the animal. The volatile principle cannot, therefore, possess much activity; but Nysten concludes that "the distilled water of opium, strongly saturated with the aromatic principle, is capable of producing drunkenness and sleep, when taken in a strong dose." (See *ante*, p. 597.)

2. Morphia.—(This will be described hereafter.)

3. Codeia (*Codeine*).—So called from *κώδεια, a poppy head.* It is a white, crystalline solid, soluble in cold, and still more so in boiling water. It is soluble in alcohol and ether. It is insoluble in a cold weak solution of potash. If more codeia be added to boiling water than this liquid can dissolve, the excess melts and forms an oily layer at the bottom of the vessel; and, by cooling, a crystalline mass is obtained. It reacts as an alkali on test papers, and unites with acids to form crystalline salts. From morphia, codeia is distinguished by its not becoming blue on the addition of a persalt of iron. It is also said not to redden nitric acid like morphia (Turner). All the specimens of codeia which I have met with became orange yellow on the addition of nitric acid. Moreover, ammonia does not precipitate it from its very diluted solution in hydrochloric acid, on account of its solubility in water; and this affords a means of separating morphia from codeia. The separation may be more easily effected by ether, which readily dissolves codeia, or by alkalies (potash or soda), which dissolve morphia, but leave codeia. From meconine it is distinguished by its aqueous solution possessing marked alkaline properties, as manifested by its action on test papers. Tincture of nutgalls produces a copious precipitate (*tannate of codeia*) in solutions of codeia.

[We have, like the author, observed that codeia and its salts acquire an orange yellow colour on the addition of nitric acid, and further that it decomposes iodic acid like morphia, and sets free iodine. The specimen examined was considered to be pure, although it is possible that traces of morphia may have been retained, and account for the reactions observed. Codeia is so soluble in water that the solution has a strong alkaline reaction. It readily yields well-defined prismatic crystals by the evaporation of its aqueous solution. These are larger, but have the same form under the microscope as those of morphia, viz. quadrangular prisms. When strong sulphuric acid is added to codeia it is somewhat reddened. On dropping into this mixture one drop of a solution of bichromate of potash there is an immediate decomposition, with change of colour, the liquid becoming rapidly green, from the liberation of green oxide of chrome. In this respect codeia resembles morphia. In fact, the chief chemical difference is that pointed out by the author, viz. the non-colouration on the addition of a persalt of iron."—ED.]

Anhydrous codeia consists of $C^{35}H^{20}NO^{5}$, Symbol $\overset{+}{\mathrm{Cd}}$. It, therefore, contains an atom less of oxygen than morphia does. [There is the same relation between the formulæ of Morphia and Codeia as between those of Cinchonia and Quina.—ED.] Its atomic weight is 284. Crystallised from ether it contains no water; but crystallised from water it retains two atoms of water of crystallisation. The *salts of codeia* have not been much studied. The *nitrate* readily crystallises. The *tannate* is insoluble in water. The *double hydrochlorate of morphia* and *codeia* is the salt at one time sold as hydrochlorate of morphia by those who prepared it by Gregory's process. Hence it has been termed by the French pharmacologists *sel de Gregory.*

The *effects* of codeia and its salts have been imperfectly examined by Kunkel, Gregory, Barbier, and Magendie, but the results are very conflicting. Kunkel[2] says it is a local irritant, becomes absorbed, excites the circulation, and produces convulsions;

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[1] Orfila, *Toxicol. Gén.*

[2] *Journ. de Chim. Méd.* ix. 223.

but that none of the animals on which the codeia was tried were either stupefied or paralysed. Magendie,[1] however, says it causes sleep, and when exhibited in large doses, stupor. He considers one grain of codeia equivalent to half a grain of morphia: two grains excite nausea and vomiting. Barbier[2] also states that it produces sleep. [Codeia after acting as a narcotic is said not to produce the headache which is often felt as a result of the action of morphia. In large doses it acts as a poison like morphia.—ED.] Dr. W. Gregory[3] says that, in doses of five or six grains, it causes an excitement like that of intoxication, followed in a few hours by depression, nausea, and sometimes vomiting. Magendie proposes to use it as a substitute for morphia, to procure sleep and allay pain, in doses of from one to three grains. A *syrup of codeia* (composed of codeia, grs. xxiv.; distilled water, f℥iv.; sugar, ℥viij.) has been used in hooping-cough. The dose for a child of about seven years of age is a teaspoonful. It has been given in irritation of the gastric mucous membrane.[4] [Six different bases have been enumerated by Anderson as products of various chemical reactions on codeia; namely, *nitrocodein*, *azocodein*, *bromcodein*, *tribromcodein*, *chlorocodein*, and *dicyancodein*.—ED.]

4. **Narcotina** (*Narcotine*).—So called from ναρκωτικὸς, *narcotic*. The greater part of the narcotina of opium is in a free state, as it is removable by ether without the aid of either acids or alkalies. It is a white, inodorous substance, crystallising in prisms, which are fluted or striated,—distinguished from morphia by being insipid, very soluble in ether, insoluble in alkalies:—by its not becoming blue on the addition of the sesquichloride of iron, by its not decomposing iodic acid, and, when quite pure, by its not yielding a brown colour when treated by chlorine and ammonia. Heated on paper over a candle it gives a greasy-looking stain to the paper. Nitric acid dissolves it, and acquires an orange tint. [Sulphuric acid turns it yellow, and on adding bichromate of potash green oxide of chrome is slowly set free.—ED.] It does not affect vegetable colours, and by this character is readily distinguished from both morphia and codeia. It is insoluble in cold water, but dissolves in 400 parts of boiling water,—in 100 parts of cold alcohol,—or in 24 parts of boiling alcohol. The volatile oils also dissolve it; it is soluble in ether. It consists of $C^{46}H^{25}NO^{14}$. The *salts of narcotina* have been but little examined. They are more bitter than those of morphia, redden litmus, and are precipitated from their solutions by infusions of nutgalls and by the alkalies. The *hydrochlorate* is crystallisable. Both this and the *sulphate* are very soluble in water.

[Orfila has suggested a test for narcotina, which produces very striking results. If to the mixture of strong sulphuric acid and narcotina, a small fragment of nitrate of potash, or any nitrate, be added, the liquid speedily acquires a deep blood red colour. Morphia treated in the same way gives a dingy brown or olive green colour. Conversely a mixture of narcotine and sulphuric acid has been proposed as a test for nitric acid or a nitrate. It is the nitric acid which here operates, and the presence of a trace of nitric acid in sulphuric acid may be often revealed by the fact that when the latter is added to narcotina it acquires a reddish tint.—ED.]

Narcotina is extracted from the residue of the opium which has been subjected to the action of cold water. This is treated with water acidulated with either acetic or hydrochloric acid, and to the filtered solution ammonia is added. The precipitate treated with boiling alcohol yields narcotina, which is deposited as the liquor cools. Narcotina may be separated from morphia by ether, which dissolves the narcotina, but leaves the morphia, or by a solution of potash, which dissolves the morphia, but leaves the narcotina, or by the cautious addition of weak acetic acid, which dissolves the morphia, and, unless the acid be greatly in excess, does not dissolve the narcotina.

When narcotina was first discovered, it was supposed to be the stimulant principle of opium; and Magendie stated, that a grain of it, dissolved in olive oil, produced the death of a dog in twenty-four hours, while twenty-four times this quantity was given, dissolved in acetic acid, with impunity. Orfila, at one time, declared it was inert, then that it acted like morphia, and subsequently that its operation was remarkable and peculiar. Bally asserts that, in a solid state, it is inert; for 129 grains may be given, at one dose, without exciting any obvious effect. The truth is, narcotina possesses but little activity; and it is probable that the first experimenters with it employed an impure substance. Dr. Roots gave gradually increased doses of it, up to a scruple, without the least injury. The bitterness of its sulphuric solution led him to employ it in intermittents, as a substitute for disulphate of quina. More recently attention has been drawn to it in India, by Dr. O'Shaughnessy,[1] as an Indian indigenous substitute for quina; and nearly 200 cases of intermittent and remittent fevers, treated by it with success, have been published.

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[1] *Formulaire*, 8me. éd. 87.

[2] *Journ. de Chim. Méd.* x. 214 & 337.

[3] *Ibid.* p. 219.

[4] *Journ. de Pharm.* xxiv. 144.

[The proportion of Narcotina contained in the different varieties of opium is, according to Dr. O'Shaughnessy, for 100 parts of Bengal Opium, 3 parts, the same for Malwah opium, while Turkey opium yields only one per cent (from notes).—ED.] One of the products of the oxidation of Narcotine is Opianic acid; on the mode of procuring and properties of which we subjoin the following remarks, from the author's notes.

Opianic Acid.—This substance is most readily obtained, according to Liebig and Wöhler, by the oxidation of narcotine in the following manner:—Dissolve narcotine in an excess of dilute sulphuric acid, add to the solution finely powdered binoxide of manganese, and apply heat. It will soon assume a yellow saffron-like colour, and evolve carbonic-acid gas. Heat to boiling, which is to be kept up until no more carbonic acid gas escapes. Both the manganese and sulphuric acid must be in excess; test for these, and then filter whilst boiling. In cooling, the fluid will nearly wholly congeal, and form a magma of fine needle-like crystals of opianic acid. The mass is to be placed on a filter to allow the yellow-coloured fluid to pass off: wash several times with cold water, press as firmly as possible, and remove impurities by treating with animal charcoal, and repeated re-crystallisation from boiling water.

Opianic acid crystallises in very small shining silky prisms of indefinite form. It is but slightly soluble in cold water, but more so in hot; so that a saturated solution, in cooling, nearly wholly crystallises, like a solution of benzoic acid. It is also soluble in alcohol. It re-acts as an acid, though it has but a faintly sour and bitter taste. It readily melts, and forms a clear oil, which crystallises on cooling, but remains amorphous if heated beyond the point of melting. It does not appear to be volatile, although it may be distilled over, a circumstance referrible to its adhesion to the sides of the retort. Heated in the air it emits an aromatic odour, similar to narcotine, which it also resembles in burning with a vivid flame and deposition of carbon. Opianic acid expels carbonic acid, and forms soluble salts, with bases. The salts of silver and oxide of lead crystallise in thin shining prisms and flakes. It contains no nitrogen.[2]

[*Cotarnine.*—There is a product of the decomposition of narcotine, namely *cotarnine* ($C^{26}H^{14}NO^{5}$), which is contained in the yellow liquid from which the crystals of opianic acid are deposited. Cotarnine is thrown down from this mixture as a double salt, either by chloride of platina or chloride of mercury. It is not soluble in cold, but very soluble in boiling water—the solution having an alkaline re-action. It is easily dissolved by ether and ammonia, but not by potash. Wöhler describes it as having an intensely bitter taste. Strong sulphuric acid gives to it a dark red colour. The persalts of iron do not affect it. Cotarnine is decomposed at a high temperature, producing a very disagreeable odour. Its action on the body does not appear to have been investigated. The name given to this base, cotarnine, is derived from a re-arrangement of the letters of the word narcotine.—ED.]

[*Narcogenine* ($C^{26}H^{19}NO^{10}$). This base was discovered by Blyth as a product of the decomposition of narcotine during its conversion to opianic acid and cotarnine. It may be procured by heating the chloroplatinate of narcotine with a small quantity of chloride of platina. The chloroplatinate of narcogenine is obtained in long transparent orange-coloured crystals. It possesses no physiological interest.—ED.]

[**5. Opianine** (Pseudo-narcotine). This base is found in Egyptian opium. It was first noticed by Kugler, but erroneously considered by him to be narcotine. Hinterberger proved that it was a distinct base having the formula $C^{66}H^{36}N^{2}O^{21}$. A saturated aqueous solution is precipitated by ammonia, the precipitate washed in water and alcohol, then dissolved in alcohol, and the solution decolorised by animal charcoal. On evaporation, crystals of morphia mixed with others resembling narcotine are obtained. By a second solution and crystallisation morphia is retained and the crystals of opianine are deposited.

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[1] *Brit. and For. Med. Rev.* vol. viii. p. 263.

[2] *Journ. für prakt. Chimie*, xxvii. pp. 97, 98.

Opianine thus procured crystallises in colourless, transparent, and brilliant-looking needles, belonging to the regular system. They are without smell, but strongly and persistently bitter to the taste, undergoing no change by exposure to air under 212°, —insoluble in cold water, but little soluble in boiling water,—with difficulty soluble in boiling alcohol:—the solution having, however, a strong alkaline reaction. Sulphuric acid produces no change in opianine: nitric acid dissolves it, acquiring a yellow colour; and if any sulphuric acid be present, this passes to a blood red, becoming after some time of a clear yellow colour.

According to its discoverer, this base has a narcotic action very similar to that of morphia, and judging from experiments on animals, quite as powerful.[1]—ED.]

6. Narceine (*Narceina*).—So called from *νάρκη*, *stupor*. It is a white, inodorous solid, crystallised in long, fine, silky needles, radiating in tufts from a centre, with a slightly bitter, and even somewhat metallic taste. It dissolves in 230 parts of boiling water, or 375 parts of water at 60°. It fuses at about 198°, and at a higher temperature is decomposed. Narceine has several very striking properties by which it is distinguished from other substances. The first of these deserving of notice is the action of mineral acids on it. Thus the sulphuric, nitric, and muriatic acids, so diluted with water that they cannot alter the elementary composition of narceine, give to this substance a fine light-blue colour, immediately on coming in contact with it. This alteration of colour does not appear to depend on any change in the elementary composition of narceine, since, by saturating the acids with ammonia, the narceine is precipitated unchanged. When much water is added, the blue colour disappears. Another peculiar trait of narceine is, that it forms a blueish compound (*iodide of narceine*) with iodine: heat and alkalies destroy the colour. These characters are sufficient to distinguish narceine from all other known substances. In addition, I may add, that it does not form a blue colour with the sesquichloride of iron, as morphia does.

Narceine was at first supposed to be a vegetable alkali; but as it does not affect vegetable colours, nor combine with nor saturate acids, it is now regarded as a neutral principle. Narceine is composed of $C^{28}H^{20}NO^{12}$. (Couerbe.)

Two grains have been several times thrown into the jugular vein of a dog, without producing any appreciable effect. It is presumed, therefore, to be inert.

7. Meconine.—So called from *μήκων*, *a poppy*. [It was discovered by Pelletier, and its properties were examined by Couerbe.—ED.] It is a white, crystalline, odourless solid. Its taste, which at first is scarcely perceptible, is afterwards sensibly acrid. The crystals are six-sided prisms, with dihedral summits. It fuses at 194°, and becomes a colourless, limpid fluid. At a higher temperature it may be distilled. It dissolves in 265 parts of cold water, or in eighteen parts of boiling water. It is soluble in alcohol and in ether. It is distinguished from morphia and codeia by its not possessing alkaline properties. From morphia it is further distinguished by its great fusibility, its greater solubility in water, and its not becoming blue on the addition of sesquichloride of iron. Cold sulphuric acid dissolves meconine, the solution being limpid and colourless. If heat be applied, the liquid becomes dark. If the quantity of sulphuric acid be small in proportion to that of meconine, the liquid assumes a green colour. If chlorine gas be passed over fused meconine, the latter becomes blood-red, and on cooling, it forms crystals. The compound thus formed is composed of chlorine and some organic base: if the first be removed by oxide of silver, a white acid is obtained, which Couerbe calls *mechloic acid* ($C^{14}H^{7}O^{10}$). By the action of nitric acid on meconine we obtain *hyponitromeconic acid*, composed of one atom of meconine and half an atom of hyponitrous acid. Meconine is remarkable for not containing nitrogen. Its composition is $C^{10}H^{5}O^{4}$.

A grain dissolved in water, and injected into the jugular vein of a dog, produced no remarkable effect. Further experiments, however, are required before we can positively declare it to be an inert substance.

8. Thebaina (*Paramorphia*).—So called from *Thebes*, an ancient city of Egypt. It is a white, crystalline, fusible solid, having an acrid, styptic taste, very soluble in alcohol and ether, but hardly at all soluble in water. It possesses alkaline properties, and dissolves in weak acids. From these solutions it is precipitated by alkalies. An excess of alkali cannot dissolve it, unless, indeed, the alkaline solution be very concentrated. It fuses at 302°, but does not volatilise at any temperature. It is distinguished from morphia by not becoming blue on the addition of the perchloride of iron, and by not forming crystallisable salts with acids. From codeia it differs in not crystallising in large crystals, and in not forming crystallisable salts. With meconine and narceine it has no analogy, and from them it is distinguished by the want of the peculiar properties which characterise these bodies. It resembles narcotina more than any other substance, but is distinguished by the crystals being shorter or granular, and wanting the pearly brilliancy possessed by those of narcotina; by its acrid taste; by its fusibility at 302°; by its greater solubility in alcohol; and by nitric acid when dropped on it converting it into a substance like a soft resin, before dissolving it. Pelletier considered it to be isomeric with morphia;—hence he called it *paramorphia*. According to Dr. Kane's analysis it consists of $C^{25}H^{14}NO^{3}$; and its atomic weight is 202. Couerbe's analysis gives another atom of oxygen. The last-mentioned chemist says that, by fusion, the crystals lose two atoms of water. Magendie states that one grain injected into the jugular vein, or placed in the pleura, acts like brucia or strychnia, and causes tetanus, and death in a few minutes.

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[1] *Chemie der Organischen Alkalien. herausgegeben*, von de H. C. Hartung-Schwartzkopf, S. 298, München, 1855.

[**9. Papaverine.**—This base was discovered by Merck in opium. Its formula is $C^{40}H^{21}NO^{8}$. An aqueous extract of opium is precipitated by soda, and the precipitate, which consists chiefly of morphia, is treated with alcohol. The alcoholic solution on evaporation leaves a dark-looking extract. This extract is digested in diluted hydrochloric acid and filtered, and ammonia now throws down from this solution a brownish-resinous-looking precipitate, containing much papaverine. This is again dissolved in hydrochloric acid, and acetate of potash added. The resinous-looking precipitate obtained by this procedure is washed with water and treated until exhausted with boiling ether. The filtered ethereal solution deposits crystals on cooling. Merck has somewhat simplified this process, but the base is rather difficult of extraction.

Papaverine crystallises in white acicular crystals, insoluble in water and with difficulty dissolved by cold alcohol or ether. Warm alcohol and ether dissolve the crystals more readily; the solutions have but a feeble alkaline reaction.

Strong sulphuric acid gives with papaverine a deep blue colour, a characteristic reaction. When heated with strong nitric acid, the whole sets with a yellow mass of crystals. The hydrochlorate, which is easily obtained, synthetically crystallises in right rhombic prisms, which are with difficulty dissolved by water. It is difficult to obtain a nitrate. Nitric acid in the slightest excess tinges the crystals yellow.

Papaverine, according to Merck, has no particular action on the animal system.—ED.]

10. Pseudomorphia.—This is a substance which Pelletier has occasionally met with in opium. It is a whitish solid, which, like morphia, dissolves in caustic alkalies, is reddened by nitric acid, and made blue by contact with the sesquichloride of iron. But it does not decompose iodic acid, and cannot form salts with acids. It consists of $C^{27}H^{18}NO^{14}$. It is not poisonous; at least, nearly eight grains, given to a rabbit, produced no effect. Pelletier thinks that pseudomorphia must be some combination of morphia, in which this substance has lost its poisonous properties.

11. Porphyroxin?—This name has been given by Merck[1] to a supposed new principle found in Bengal opium. It is described as crystallisable, fusible, soluble in alcohol, ether, and weak acids. Alkalies precipitate it from its acid solution. Further experiments are required to determine its existence and precise nature.[2]

12. Resin.—Brown, insipid, inodorous, softened by heat, insoluble in water and ether, but soluble in alcohol and in alkaline leys. Nitrogen is a constituent of it.

13. Extractive.—The substance usually denominated the extractive of opium is probably a heterogeneous body. It is brown and acid, and has been supposed to be one of the active principles of opium. The reasons for this opinion are the following:—In the *first* place, it has been asserted that after the morphia has been separated from an infusion of opium by magnesia, the filtered liquor gives by evaporation an extract which produces the same kind of narcotic effect that opium does.[1] *Secondly*, the effects of the known active principles of opium are not sufficiently powerful to authorise us to refer the whole of the active properties of opium to them. Thus on an average 100 parts of opium yield from 8 to 10 parts of morphia (the most active of the known constituents of opium), and, therefore, if this alkali were the only active principle, it ought to be 10 or 12 times as powerful as opium is. Now we know that morphia is but little, if at all, more active than opium, and, therefore, this last-mentioned substance either contains some other active principle, or the activity of morphia is surprisingly increased by the principle or principles with which it is naturally in combination. Butter[2] says the insoluble residuum possesses considerable narcotic qualities.

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[1] *Pharm. Central-Blatt für* 1837, S. 342; and *Brit. Ann. of Med.* ii. 82.

[2] [We find no confirmation, since the previous edition, of the existence of this substance as an independent base. Schwarzkopf, in his recently published elaborate work on the organic alkaloids of the vegetable kingdom, does not notice it.—ED.]

14. Fatty Matter.—Yellow or brownish. Probably colourless when pure. It reddens litmus, and unites with alkalies to form soaps, from which acids disengage it apparently unchanged.

15. Meconic Acid.—Hitherto found in the poppy tribe only. It is usually procured from meconate of lime by acting on it, in hot water, with hydrochloric acid. The meconic acid crystallises on cooling. The formula of the anhydrous acid is $C^{14}HO^{11}$. The crystallised acid contains 9 equivalents of water; and the acid dried at 212° contains 9 equivalents of water. [The symbol of meconic acid is Me. The formula of the anhydrous acid is $C^{14}HO^{11}=Me$; of the acid dried at 212°, $C^{14}HO^{11}=\overline{Me}+3$ aq.; of the crystallised acid, $C^{14}HO^{11}+3HO+6aq=\overline{Me}+9aq$. It is admitted by chemists to be a tribasic acid.—ED.] When pure it is in the form of white, transparent, micaceous scales, which are soluble in four times their weight of boiling water. But at this temperature water decomposes it; carbonic acid is evolved, and a solution of *komenic acid* ($C^{12}H^{2}O^{8}+2$ aq.) is obtained. Cold water dissolves a smaller quantity of meconic acid. Alcohol is also a solvent for meconic acid. By the dry distillation of meconic acid it loses carbonic acid and water, and becomes *pyromeconic acid* ($C^{10}H^{3}O^{5}+$aq.)

The *characteristics* of meconic acid are as follows:—1st. *It reddens the neutral sesquisalts of iron*, forming the *meconate of the sesquioxide of iron*. Alkalies, protochloride of tin, and nitric acid, assisted by heat, destroy this red colour. A solution of corrosive sublimate, which destroys the red colour of sulphocyanide of iron, does not decolorise a red solution of meconate of iron. 2dly. It forms, with a weak solution of *ammoniated sulphate of copper*, a green precipitate (*meconate of copper*). 3dly. It yields white precipitates (*meconates*) which are soluble in nitric acid, with *acetate of lead*, *nitrate of silver*, and *chloride of barium*. The alkaline acetates which, like meconic acid, redden the sesquisalts of iron, and might, therefore, be confounded with it, do not occasion precipitates with the salts of lead and of barium. [Besides, the meconate of lead is insoluble in acetic acid; and if a solution of an alkaline acetate be first boiled with a few drops of diluted sulphuric acid, it is not reddened by a sesquisalt of iron.—ED.] 4thly. It is not reddened by *chloride of gold*, which reddens hydrosulphocyanic acid and the sulphocyanides.

It deserves especial notice that many substances possess equally with meconic acid the power of communicating a red colour to the sesquisalts of iron. The following are some of them:—the *acetates*, *hydrosulphocyanic acid*, and the *sulphocyanides*, the *saliva of man* and *of the sheep*, the *urine* of man (frequently), *infusion of white mustard*, *komenic*, *pyromeconic*, and *indigotic acids*, the liquid obtained by the action of hydrochloric acid on detonating silver, the decoctions of *Cetraria islandica* and of *Gigartina Helminthocorton*.

Meconic acid is believed to be an inert substance. Sertürner swallowed five grains of it without observing any effect. Sömmering gave ten grains to a dog; Fenoglio and Blengini gave eight grains to dogs, cows, and frogs, and four grains to various men: in all cases no effects were observed.[3] Combined with bases, it doubtless modifies their action. Meconate of soda, however, is not active, as Sertürner asserted. It is supposed that the effect of the morphia in opium is modified by its combination with meconic acid. I have already mentioned that this acid is said to be an antidote

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[1] Berzelius, *Traité de Chim.* t. v. p. 136; and t. vi. p. 152.

[2] *Op. supra cit.*

[3] Richter, *Ausf. Arzneim*, Bd. ii. S. 616.

TABULAR VIEW OF THE PRINCIPAL CHARACTERS OF THE CRYSTALLINE PRINCIPLES OF OPIUM.

Characters.		MORPHIA.	PSEUDOMORPHIA.	CODEIA.	NARCOTINA.	THEBAINA.	NARCEINE.	MECONINE.
Taste		Very bitter	... ? ...	Bitter	Insipid; the salts bitter	Rather acrid and metallic	Slightly bitter...	Rather acrid.
Fusibility		Fusible	Infusible ?	Fusible at 302°	Fusible at 338°	Fusible at 226°	Fusible at 198°	Fusible at 194°.
Ditto in Boiling Water		Infusible	Infusible	Fusible	... ...	... ...	Fusible	Fusible.
Solubility in	*Cold Water*	Insoluble or nearly so	Almost insoluble	Soluble in 80 pts.	Insoluble	Very slightly soluble	Soluble in 375 parts	Soluble in 266 parts.
	Boiling Water	Soluble in 100 parts		Soluble in 17 parts	Very slightly soluble		Soluble in 230 parts	Soluble in 19 parts.
	Cold Alcohol	Ditto in 40 pts.	Less soluble than in water	Very soluble	Soluble in 100 parts	Soluble in 10 pts.	Soluble	Soluble.
	Boiling Alcohol	Ditto in 30 pts.				Still more soluble	More soluble	Soluble.
	Cold Ether	Scarcely solu.			Readily solu.	Very soluble	Insoluble	Soluble.
	Potash or Soda Ley	Soluble	Soluble	Insoluble in the cold ley	Insoluble, or nearly so	Insoluble, unless the ley be very concentrated	... ...	Soluble.
Basic quality	*Action on Test Paper*	Alkaline	... ? ...	Alkaline	Neutral	Alkaline	Neutral[1]	Neutral.
	Salifiability	Salifiable	Not salifiable	Salifiable	Salifiable	Salifiable	Not salifiable	Not salifiable.
Action of Nitric Acid		Reddened: solution red	Reddened	Solution not red	Made yellow: solution yellow	Gives it a resinous appearance & dissolves it	Coloured blue by dilute acid	Solution yellow.
Coloured blue by Hydroch. Acid		... Not ...	... Not ...	... Not ...	... Not ...	... Not ...	Coloured blue...	... Not.
Ditto by Sesquichloride of Iron		Coloured blue...	Coloured blue...	... Not ...	... Not ...	... Not ...	... Not ...	... Not.
Coloured blue by Iodine		... Not ...	... ? ...	... Not ...	... Not ...	... Not ...	Coloured blue...	... Not.
Decomposes Iodic Acid		Decomposes Iodic acid..	... ? ...	... Not ...	... Not ...	... Not ...	... Not ...	... Not.
Precipitated by Infusion of Nutgalls		Precipitated ...	... ? ...	Precipitated ...	Precipitated ...	... ? ...	... ? ...	... ?
When fused reddened by Chlorine Gas		... Not ...	... ? ...	... Not ...	... Not ...	... Not ...	... Not ...	Blood-red.
Composition		$C^{35}H^{20}N^{1}O^{6}$	$C^{27}H^{18}N^{1}O^{14}$	$C^{35}H^{20}N^{1}O^{5}$	$C^{48}H^{24}N^{1}O^{15}$	$C^{25}H^{14}N^{1}O^{3}$	$C^{28}H^{20}N^{1}O^{12}$	$C^{10}H^{5}O^{4}$.
Equivalent		... 292 ...	... 306 ...	... 284 ...	... 446 ...	... 202 ...	... 298 ...	97 (?).
Water of Crystallisation		2 atoms	... ? ...	2 atoms	3 or 4 per cent.	1 atom	... ? ...	None.[*]
Poisonous		Poisonous	Not poisonous...	Poisonous	Inert ?	Poisonous	Inert ?	Inert ?

⁂ I have had no opportunity of verifying the statements in this column.

in cases of poisoning by corrosive sublimate. If, however, the statement be true, the fact is of little practical value, on account of the scarcity of the acid; for neither opium nor laudanum can be given in quantity sufficient to neutralise the effect of this salt, without proving deleterious. Moreover, we have other good and easily accessible antidotes. Anthelmintic properties have been ascribed to the acid and some of its salts.

Chemical Characteristics.—Litmus paper is reddened by a watery infusion of opium (or tincture of opium diluted with water), owing to a free acid (*meconic*). Sesquichloride of iron gives it a deep red colour (*meconate of iron*). Acetate and diacetate of lead occasion a copious grey precipitate (*meconate and sulphate of lead, with colouring matter*), which, treated by sulphuric acid or sulphuretted hydrogen, yields free meconic acid. Chloride of barium also causes a precipitate (*meconate and sulphate of baryta*). Ammonia renders the infusion turbid (*precipitated morphia and narcotina*). Tincture of nutgalls causes a precipitate (*tannates of morphia* and *codeia*). Nitric acid communicates to the infusion a red colour (*oxidised? morphia*). Iodic acid and starch cause, after some hours, a blue precipitate (*iodide of starch*). This last test does not always succeed. Chloride of gold causes a deep fawn-coloured precipitate.

Application to Medico-legal Purposes.—On examining the alimentary canal of persons destroyed by opium, it not unfrequently happens that no traces of the poison can be obtained. I have met with several instances of this, and others are referred to by Dr. Christison.[1] Either, therefore, opium is rapidly absorbed, and its unassimilated parts are thrown out of the system by the excretories, or the constituents of this substance are digestible and assimilable. [One or the other of these conclusions must be admitted, or it must be assumed that morphia and meconic acid remain in the body as such, unchangeable and unchanged, and the non-discovery of opium by such cautious analysts as Dr. Christison and the late Dr. Pereira must be ascribed to want of skill or the adoption of an imperfect process! For our part we can confirm the testimony of the author and Dr. Christison on this important subject; and we reject, as an untrue and dangerous dogma, the assertion made by a few chemists at a late important trial, that when death has been caused by a vegetable alkaloid, it must invariably be found in the dead body. There is no doubt, however, that one chemist may swear to results which another would reject as unsatisfactory.—Ed.]

The characters available for the detection of opium are two-fold, *physical* and *chemical.*

1. *Physical Characteristics.*—Whether in the solid state, or dissolved in water or spirit, opium possesses three physical properties, by one or more of which it may be frequently recognised. These are, *a more or less brown colour*, *a remarkable and peculiar odour*, and *a bitter taste*. Of these the odour is the only characteristic one. In the alimentary canal it is strongest when the stomach is just opened, or when the opiate liquor is just reaching the boiling point. Other odours, however, frequently mask it. The analogy between the odours of lactucarium and opium deserves notice.

2. *Chemical Characteristics.*—The chemical tests of opium are those for meconic acid and morphia above mentioned. In a case of suspected poisoning, the stomach and duodenum (cut into small pieces), with their contents, are to be digested in distilled water, and the solution filtered successively through a sieve, muslin, and paper. A little acetic acid added to the water coagulates any caseine, and is thought to facilitate the solution of the morphia. Its presence in large quantity is not necessary, and is objectionable on account of the red colour produced by the action of the acetates on the ferruginous salts: this resembles the colour developed with these salts by meconic acid.

α. Application of trial tests.—To a small portion of the filtered liquid apply the following tests:—

1. A few drops of *tincture of chloride of iron*, which produces a red colour (*meconate of iron*) in an opiate solution.

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[1] *On Poisons.*

2. Apply excess of *strong nitric acid*, which also reddens (*oxidises? morphia*) opiate liquors.

3. Add *iodic acid* and *starch*, and set aside for twenty-four hours. Blue iodide of starch is sometimes formed if morphia be present (unless, indeed, the quantity be very minute).—The *fallacies* of these tests are elsewhere stated (see MORPHIA).

The success or failure of these tests is not to be considered as absolutely decisive as to the presence or absence of opium.

β. *Separation of the Morphia and Meconic Acid.*—Add to the filtered liquor a considerable excess of a solution of acetate of lead, and set aside in a tall vessel for the precipitate (*meconate and sulphate of lead, with colouring matter*) to subside, leaving a clear liquor (*acetates of morphia and lead*, &c.) Pour off the latter, and collect the precipitate on a filter. Before adding the acetate of lead, it may be sometimes necessary to evaporate the liquor, in a water-bath, to the consistence of syrup, which is to be digested and boiled in alcohol, and the alcoholic tincture evaporated, and the residuum dissolved in water. To the filtered solution add the acetate of lead. This complication of the process is not usually necessary. Furthermore, by boiling with water, meconic acid is decomposed.

The above-mentioned clear liquor and the lead-precipitate are then to be tested (the first for morphia, the second for meconic acid), as follows:—

1. *Proceeding with the lead-precipitate* (meconate and sulphate of lead, and colouring matter).

Suspend the lead-precipitate in water contained in a conical glass, and pass a stream of sulphuretted hydrogen through it, to convert the lead into a sulphuret, which is to be removed by filtration. The clear liquor is then to be gently heated (to expel the excess of sulphuretted hydrogen), and, if necessary, concentrated, by evaporation. Or, add a few drops of diluted sulphuric acid to the meconate of lead, by which an insoluble sulphate of lead is formed, and meconic acid held in solution. Boiling decomposes the meconic acid. The tests for meconic acid are then to be applied, viz.:—

a, Tincture of chloride of iron.
b, Ammoniacal sulphate of copper.
c, Chloride of gold.
d, Acetate of lead.

2. *Proceeding with the clear liquor* (solution of the acetates of morphia and lead).

Place the clear liquor in a conical glass, and pass through it a stream of sulphuretted hydrogen, to precipitate the lead, and then filter. Then boil the filtered liquor, and, if necessary, concentrate by evaporation. To the clear liquor apply the tests for morphia, viz.:—

a, Strong nitric acid in excess.
b, Iodic acid and starch (several hours may be necessary for the success of this test).
c, Tincture of chloride of iron (this test will only succeed with solid morphia, or very concentrated solutions).
d, Ammonia.
e, Infusion of nutgalls (this test will not answer if much free acid be in the liquor).
f, Chlorine, and afterwards ammonia.

[In reference to this process we find that the meconate of lead may be readily made to yield its meconic acid, by boiling it with a few drops of diluted sulphuric acid; and the separated meconic acid is not so affected as to prevent the reaction of the iron-test, which is undoubtedly the best. The sulphuric acid removes one possible source of fallacy, by decomposing any acetate, and the boiling temperature expels the acetic acid. It will be found difficult to procure morphia in the solid state from the clear liquor; and yet, without it, none of the tests enumerated can be considered satisfactory.[1] A more detailed account of the chemical characters of morphia and meconic acid will be found under the special history of these substances.—ED.]

[*Stas's Process.*—M. Stas, a Belgian chemist, has recommended the employment of ether for the extraction of morphia in organic mixtures containing opium. He procures, at a temperature not exceeding 160°, an alcoholic extract of the article requiring examination, mixing with the substance a small quantity of oxalic or tartaric acid for the purpose of rendering the alkaloid soluble. The acid extract is filtered, and the residue exhausted with strong spirit. This is concentrated *in vacuo* by the aid of sulphuric acid, or at a temperature not exceeding 100°. The liquid is filtered through a wet filter, to separate any fatty matters dissolved by the spirit; and is again evaporated *in vacuo* nearly to dryness. The residue is now exhausted with absolute alcohol, this liquid evaporated, and the acid residue dissolved in a minimum of distilled water. To this acid, aqueous solution, finely powdered, and pure bicarbonate of soda or potash, is cautiously added, until there is no longer effervescence and the liquid is neutralised. It is then shaken in a tube with from four to six times its volume of pure rectified ether. The stratum of ether which floats on the liquid is subsequently poured off and evaporated,—when crystals of the alkaloid, if present, are obtained. Otto states that he has not found this process satisfactory for the detection of morphia, in consequence of the great insolubility of morphia in ether.[1] It has been pointed out by Polstorff that, in order to remove the alkaloid under these circumstances, the ether must be added immediately after the alkaline carbonate, and the supernatant liquid poured off as quickly as possible. If the morphia once separates in the crystalline state, either on the addition of the carbonate of soda or as a result of the ether being allowed to stand some time on the liquid, it cannot be procured. This is, therefore, as we have found it in practice, a process of great delicacy and of considerable uncertainty. The quantity of morphia removed by the ether is by no means the whole quantity present. It has been suggested that the addition of a small quantity of alcohol to the ether improves its solvent powers. Morphia is quite soluble in pure soda or potash, and ether cannot extract it from this alkaline solution.

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[1] Schwarzkopf and Otto. *Op. cit.*

When the morphia is thus obtained its crystalline form should be noticed by the microscope. Its insolubility in water, solubility in alcohol or weak acids, with the bitter taste of the liquid, should also be observed. The actions of nitric acid and of iodic acid on the pure morphia are very characteristic, but they are unsafe as tests when applied to crystals still containing organic matter. Hence it is better to operate on a small quantity of morphia in a pure state than on a large quantity in an impure state. It will be perceived that Stas's process fails in one important point. It makes no provision for the detection of *meconic acid*. The most simple plan for obtaining this additional evidence is that recommended by the author. The presence of meconic acid must be determined before we can infer that *opium* was present in the substance examined. If morphia alone be found, this may be ascribed to the presence of that alkaloid or of one of its salts.—ED.]

Dr. Christison observes, that "it will often happen, in actual practice, that the only indication of opium to be procured by the process consists in the deep red colour struck by permuriate of iron with the meconic acid. Now, will this alone constitute sufficient proof of the presence of opium? On the whole, I am inclined to reply in the affirmative." I regret I cannot agree with him in this conclusion, since several other substances produce the same colour, and three of these are very likely to be met with in the alimentary canal, namely, the acetates (thus acetate of ammonia or acetate of potash administered medicinally), mustard, and saliva. [It is also to be remarked that the colour of the acetate of iron is not destroyed by a solution of corrosive sublimate.—ED.] In regard to saliva, he remarks, "it is seldom possible to procure a distinct blood-red colouration from the saliva, except by evaporating a large quantity to dryness, and re-dissolving the residue in a small quantity of water; and I question whether it can be separated at all after the saliva is mixed with the complex contents of the stomach." In a large majority of cases, however, I find saliva is distinctly and unequivocally reddened by the persalts of iron. In some few cases only have I observed this test indistinct. I have several times obtained from the stomach of subjects in the dissecting-room a liquor which reddened the salts of iron. [Our experience is in accordance with that of the author. A small quantity of saliva which has not undergone any preparation is reddened by a persalt of iron; and we have obtained in extracts of the dead stomach a colour similar to that produced by the meconate of iron, when there could be no suspicion of opium having been taken.—ED.]

ESTIMATION OF THE PURITY AND STRENGTH OF OPIUM.—Opium is brought into the market of very unequal degrees of purity, in consequence of its having been subjected to adulteration; and partly, perhaps, from the employment of different methods of preparation. Moreover, its consistence is by no means uniform; that of some kinds being quite soft (as the Patna and Benares), and of others quite hard (as some of the

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[1] *Ausmittelung der Gifte Braunschweig*, 1856, p. 97.

Egyptian opium). As this difference depends on the presence of unequal quantities of water, an obvious variation of strength is the consequence. Moreover, the quantity of morphia in good opium of different or even of the same localities is by no means constant. Furthermore, opium, from which the morphia has been extracted, has been fraudulently introduced into commerce.[1] It is highly desirable, therefore, to have a ready, easy, accurate, and precise method of determining the purity and strength of opium. I regret to state that such a method is still a desideratum.

1. Of the Estimation of the Water.—This will be readily judged of by the consistence, but still better by observing the loss on drying a given weight of the opium at 212°.

2. Of the Detection of Foreign Bodies.—A physical examination of opium will frequently detect impurities (as leaves, bullets, stones, fruit, &c.) If a decoction of the suspected opium be made and strained, various foreign matters are left on the sieve. In this way I obtained 10 drachms of small stones and gravel from 10 ounces of opium. On another occasion I detected a gelatiniform substance, which was insoluble in both water and alcohol, in an opium (Egyptian?), the tincture of which could not be rendered clear by filtration. A decoction of opium, when cold, should not give a blue precipitate (*iodide of starch*) on the addition of tincture of iodine: if it do, the presence of starch or flour is obvious.

[Landerer has pointed out, among the adulterations of opium which take place in the Levant, the occasional presence of *glucose*, derived, as he states, from the addition of grape juice. To a certain extent this is true, but it is proper to observe that M. Magnes Laheus has detected glucose as a natural constituent of poppy juice. In a specimen of Turkey opium Landerer found 14·5 per cent. of glucose. The French indigenous opium, obtained by the process of M. Aubergier,[2] contains only about one half of this quantity.[3]—Ed.]

3. Of the Estimation of the Quantity of Morphia in Opium. (*Morphiometry.*—This is a subject of no slight difficulty. A remark connected with it, which deserves notice, is, that there is no constant ratio between the quantity of morphia in a given sample of opium and that of any other constituent. Berthemot,[4] however, is of opinion that it is in the ratio of that of the meconic acid. The correctness of this opinion is not borne out by my own observation, and was positively denied by Robiquet.[5] It follows, therefore, that the extraction of the morphia is the only true morphiometrical method of proceeding. Several methods of effecting this have been proposed.

α. Process of the Edinburgh Pharmacopœia.—"A solution of 100 grains, macerated 24 hours in two fluidounces of water, filtered, and strongly squeezed in a cloth, if precipitated by a cold solution of half an ounce of carbonate of soda in two waters, and heated till the precipitate shrinks and fuses, will yield a solid mass on cooling, which weighs, when dry, at least 11 grains, and, if pulverised, dissolves entirely in a solution of oxalic acid."—*Ph. Ed.* 1839. This is a modification of the process for procuring disulphate of quina, and of estimating the quality of yellow bark. The fused mass obtained by the process is morphia, narcotine, and resinous extractive. From the trials I have made of this process, I am inclined to speak very doubtfully of its value. Morphia is soluble in a solution of carbonate of soda, and, therefore, variations in the degree of heat applied to the liquor, as well as in the time during which it is subjected to heat, will be attended with corresponding variations in the results. Nay, if the heat be maintained too long, the whole of the morphia will be dissolved! Hence, therefore, to prove successful, this process requires more precautions than the directions of the College would lead one to imagine.

β. Thiboumary's process.—Prepare an aqueous extract of the opium to be examined, and dissolve it in water. Add ammonia to the boiling liquor, [taking care not to add much excess] and, when cool, filter. Wash the precipitate on the filter first with cold water, then with proof spirit, and afterwards dry it. Then boil it with animal charcoal in rectified spirit, and evaporate the filtered liquor, by which crystals of morphia are procured.[1] — The following modifications of the process will be found valuable. After the precipitate on the filter has been washed with water, dry it, mix it with proof spirit, and add drop by drop acetic acid until the solution slightly reddens litmus. By this means the morphia, and not the narcotina, will be dissolved. Precipitate the morphia from the filtered solution by ammonia. This perhaps is the best process for determining the goodness of opium at present known.

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[1] *Journ. de Pharm.* xxiv. 325, 446; xxv. 297; also *Journ. de Chim. Méd.* iv. 2nde Sér. pp. 335, 432.

[2] See *antè*, p. 603.

[3] Bouchardat, *Annuaire de Thérapeutique*, 1855, p. 11.

[4] *Journ. de Pharm.* xxiv. 445.

[5] *Ibid.* p. 438.

γ. *Berthemot's process.* — To a filtered infusion of opium add chloride of calcium, boil, filter (to get rid of the meconate and sulphate of lime), and evaporate to the consistence of syrup. The residuum should form a granular crystalline mass (principally hydrochlorate of morphia), which is to be separated from the mother-water, and purified by re-solution in water.[2] This is an application of Gregory's process, hereafter to be described. It appears to be an objectionable method, as a considerable portion of the morphia will be left in the mother-liquor.

δ. *Couerbe's process.* — Boil an infusion of opium with lime (which dissolves the morphia) and filter through paper. Saturate the filtered liquor with an acid, and precipitate the morphia by ammonia. This, perhaps, is the most speedy process for the detection of opium.

[As a summary of the characters of good opium we subjoin the following paragraph, which we find among the author's notes: —

1. Treated with cold water it ought to completely divide itself. The extractive matter should be dissolved, and the resinoid matter should be separated.

2. The liquor, which is at first turbid, should become clear by repose, and assume a more or less deep brown colour.

a. It should give a wine red colour with persalts of iron (meconic acid).

b. It should give a whitish precipitate with chloride of calcium by the aid of heat (meconate and sulphate of lime). The supernatant liquor, filtered and concentrated by evaporation, should deposit crystals of muriate of morphia.

c. It should give with ammonia dropped into the boiling liquor, a precipitate especially after cooling, consisting of coloured morphia mixed with resin, narcotine, and a little meconate of lime.

Some of the peculiar ingredients of opium are not discoverable in the infusion or decoction; such as narcotina, codeia, meconine, narceine, and thebaina. — ED.]

PHYSIOLOGICAL EFFECTS. *a. On Vegetables.* — The effects of opium on plants have been principally examined by Marcet[1] and Macaire.[2] The latter writer states, that the stamens of the barberry (*Berberis vulgaris*) and the leaves of the sensitive plant lost their contractility, and soon died, when the stems of these vegetables were immersed in an aqueous solution of opium. But I have tried this experiment with a different result. I immersed a flowering stem of the barberry in water, to which the tincture of opium had been added. In thirty hours I could not perceive any effect on the plant. The stamens, even in the overblown flowers, still retained their contractility. Charvet states that he watered a sensitive plant with a moderately strong infusion of opium forty-eight days, without affecting the irritability of the plant. By immersing a portion of Chara in a solution of opium, the circulation of this plant becomes slower, is soon suspended, and is ultimately stopped.[5]

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[1] *Journ. de Chim. Méd.* iv. 405, 2e Sér.

[2] *Journ. de Pharm.* xxiv. 448.

[3] *Ann. de Chim. et Phys.* xxix. 20.

[4] *Ibid.* xxxix. 213.

[5] Meyen, *Report on the Progress of Vegetable Physiology during the year* 1837, translated by W. Francis, p. 14, Lond. 1839.

β. *On Animals generally.*—The operation of opium on animals has repeatedly been the subject of physiological investigation. An abstract of a considerable number of experiments made by various individuals has been published by Wibmer.[1] The most complete and extended series of experiments is that made by Charvet,[2] on the different classes of animals, for the purpose of determining its comparative action. While on all it has been found to act as a poison, its effects are observed to vary somewhat, according to the degree of development of the nervous system.

In the invertebrated animals opium causes weakness or paralysis of the contractile tissues, with gradual sinking, and death. Thus in the *polygastrica* and the *annelides*, it first accelerates the animal movements, but afterwards paralyses them. Now in the lower invertebrata, a central nervous apparatus is altogether wanting; while in the higher animals of this class it is not sufficiently developed to exercise that influence over the whole individual which we observe it to possess in the vertebrated classes.

In the vertebrated animals we have a high development of the central organs of the nervous system, and a consequent increase in the number of symptoms caused by opium. Thus in *fishes*, *amphibials*, and *reptiles*, we observe, in addition to the weakened and paralytic condition of the contractile tissues, convulsions. In fish, the convulsive contractions bend the body laterally; whereas, in the other vertebrata, the superior dorsal muscles are affected, and hence, the head and tail are elevated. These differences obviously depend on the disposition of the muscles. Proceeding in the ascending order, we observe in *birds* and *mammals*, besides the paralysis, and convulsions, stupor. The last-mentioned symptom, however, is principally manifested in the highest of the mammals, man,—that is, in that animal which has the most highly developed brain, while, in some of the lower mammals, as the ruminants, it is scarcely observed; and even in the carnivora, as dogs, it is very slight. It is somewhat remarkable that the stupor is more manifest in birds than in the lower mammals. Moreover, it is not undeserving of notice, that the operation of opium on the different races of man is not uniform. On the negro, the Malay, and the Javanese, it more frequently acts as an excitant, causing furious madness, or delirium and convulsions. Are we to ascribe the less frequent occurrence of these symptoms in the Caucasian variety to the greater development of his brain? In conclusion, then, it appears that the effects of opium on the animal kingdom have a relation to the degree of development and influence of the nervous system.

γ. *On Man.*—I propose to examine the effects of opium under three heads or subdivisions:—*first*, the effects of one or a few doses employed medicinally; *secondly*, the effects of the habitual employment of opium, either by chewing or smoking it; and *thirdly*, its effects on the different systems of organs.

1. *Effects of one or a few doses.*—We may consider these under three degrees of operation.

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[1] *Wirk. d. Arzneim. u. Gifte*, Bd. iv. S. 74, et seq.

[2] *De l'Action comp. de l'Opium*, Paris, 1826.

First degree of operation.—In *small doses*, as from a quarter of a grain to one grain, opium generally acts as a stimulant, though in this respect the symptoms are not uniform. Usually the vascular system is somewhat excited, and a sensation of fulness is experienced about the head. Dr. Crumpe[1] took one grain of opium when his pulse was at 70, and the alteration in the number of beats was as follows:—

In	2	5	10	15	20	25	30	35	40	45	50	55	60 minutes.
Pulse beat	70	74	76	76	74	74	74	72	72	70	70	70	70

The excitement in the cerebral vascular system is accompanied by alterations in the condition of the nervous functions. The mind is usually exhilarated; the ideas flow more quickly; a pleasureable or comfortable condition of the whole system is experienced, difficult to describe; there is a capability of greater exertion than usual. These symptoms are followed by a diminution of muscular power, and of susceptibility to the impression of external objects; a desire of repose is experienced, with a tendency to sleep. While these effects are taking place, the mouth and throat become dry, and hunger is diminished, though the thirst is increased: and slight constipation usually follows. Such are the ordinary effects of a small dose of opium on persons unaccustomed to its use. By repetition, however, its influence becomes considerably diminished; and those, therefore, who resort to it for the purpose of producing a pleasureable excitement, are obliged to augment the dose to keep up an equal effect.

Second degree of operation.—Given in a *full medicinal* dose (as from two to four grains), the stage of excitement is soon followed by that of depression. The pulse, which at first is increased in fulness and frequency, is afterwards reduced below the natural standard. The effect of two grains and a half on Dr. Crumpe (when his pulse was beating at 70) was as follows:[2]—

In	5	10	15	20	25	30	35	40	45	50	55	60	75	90 minutes.
Pulse beat	74	74	74	76	78	80	72	70	64	64	66	70	70	70

The skin becomes hot; the mouth and throat dry; the appetite diminished; the thirst increased; and frequently nausea, or even vomiting, is induced. The symptoms of excitement soon pass away, and a state of torpor succeeds: the individual seems indisposed to exertion; the muscular system appears enfeebled; the force of external impressions on the organs of the senses is diminished; and the ideas become confused. This state is followed by an almost irresistible desire to sleep, which is frequently attended by dreams—sometimes of a pleasing, at others of a frightful nature. These effects are usually succeeded by constipation (which may continue for several days), by nausea, furred tongue, headache, and listlessness.

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[1] *Inq. into the Nat. and Prop. of Opium*, p. 33, 1793.

[2] *Op. supra cit.* p. 85.

Third degree of operation: poisonous effects of opium. — Dr. Christison has so briefly summed up the effects of a poisonous dose of opium, that I cannot do better than quote his statement: — "The symptoms of poisoning with opium, when it is administered at once in a dangerous dose, begin with giddiness and stupor, generally without any previous stimulus. The stupor rapidly increasing, the person becomes motionless and insensible to external impressions; he breathes very slowly, generally lies quite still, with his eyes shut and the pupils contracted; and the whole expression of the countenance is that of deep and perfect repose. As the poisoning advances, the features become ghastly, the pulse feeble and imperceptible, the muscles exceedingly relaxed, and, unless assistance is speedily procured, death ensues. If the person recovers, the sopor is succeeded by prolonged sleep, which commonly ends in twenty-four or thirty-six hours, and is followed by nausea, vomiting, giddiness, and loathing of food." [There is a smell of opium in the breath, although this may be concealed in some instances by other odours. — ED.]

2. *Habitual use of Opium.* — Of those who habitually employ opium as an intoxicant, some chew, or eat it; others smoke it.

Opium-eating. — The ill effects of opium-eating have been described by most travellers in Turkey and Persia, where this practice is carried to a greater extent than in any other part of the world. In the writings of Dr. Russell,[1] Chardin,[2] the Baron de Tott,[3] Pouqueville,[4] and Madden,[5] will be found notices of these effects. The following extract is from one of the latest accounts, that of Dr. Oppenheim:[6] —

> "The causes leading to the use of opium are many, and among them may be reckoned the following: — long-continued diarrhœa, as a remedy for which opium is used in the first instance, and its use afterwards continued from habit; chronic coughs, in which opium is used as a popular remedy; habitual drunkards also frequently have recourse to opium as a new stimulus, after they have abjured wine in some fit of repentance. Persons holding high offices or dignities in the state have recourse to opium, when the preservation of their character forbids them the use of wine: some very strict believers also take opium as a restorative in cases of great exertion, as the *Tartars* (couriers), who travel with astonishing celerity. Opium-eaters generally begin with doses of from half a grain to two grains, and gradually increase the quantity till it amounts to two drachms and sometimes more a day: they usually take the opium in pills, but avoid drinking any water after having swallowed them, as this is said to produce violent colic: to make it more palatable, it is sometimes mixed with syrups or thickened juices; but in this form it is less intoxicating, and resembles mead; it is then taken with a spoon, or is dried in small cakes with the words '*Mash Allah*,' 'the work of God,' imprinted on them. The effect of the opium manifests itself one or two hours after it has been taken, and lasts for five or six hours, according to the dose taken and the idiosyncrasy of the subject. In persons accustomed to take it, it produces a high degree of animation, which the *Theriaki* (opium-eaters) represent as the acmé of happiness.
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> "The habitual opium-eater is instantly recognised by his appearance. A total attenuation of body, a withered, yellow countenance, a lame gait, a bending of the spine, frequently to such a degree as to assume a circular form, and glossy, deep-

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[1] *Nat. Hist. of Aleppo*, i. 126, 1794.

[2] *Voy. en Perse et autres Lieux de l'Orient.*

[3] *Mém. sur les Turcs et les Tart.* 1785.

[4] *Voy. en Morée, en Constant.* t. ii. p. 123, 1805.

[5] *Travels in Turkey*, &c. vol. i. p. 23, 1829.

[6] *Ueber d. Zust. d. Heilk. u. über d. Volshrankh. in d. Europ. u. Asiat.-Turkei*, Hamb. 1838. Also *Brit. and For. Med. Rev.* vol. iv. p. 394.

sunken eyes, betray him at the first glance. The digestive organs are in the highest degree disturbed, the sufferer eats scarcely anything, and has hardly one evacuation in a week: his mental and bodily powers are destroyed,—he is impotent. By degrees, as the habit becomes more confirmed, his strength continues decreasing, the craving for the stimulus becomes even greater, and, to produce the desired effect, the dose must constantly be augmented. When the dose of two or three drachms a day no longer produces the beatific intoxication so eagerly sought by the Opiophagi, they mix the opium with [corrosive] *sublimate*, increasing the quantity till it reaches to ten grains a day; it then acts as a stimulant. After long indulgence the opium-eater becomes subject to nervous or neuralgic pains, to which opium itself brings no relief. These people seldom attain the age of forty, if they have begun to use opium at an early age. The fasts in the month of Ramasan are for them fraught with the most dreadful tortures, as during the whole of that month they are not allowed to take any thing during the day. It is said that, to assuage their sufferings, they swallow before the morning prayer, besides the usual dose, a certain number of other doses, each wrapped up in its particular paper, having previously calculated the time when each envelope shall be unfolded, and allow the pill to produce the effects of their usual allowance. When this baneful habit has become confirmed, it is almost impossible to break it off; the torments of the opium-eater, when deprived of this stimulant, are as dreadful as his bliss is complete when he has taken it; to him night brings the torments of hell, day the bliss of paradise. Those who do make the attempt to discontinue the use of opium, usually mix it with wax, and daily diminishing the quantity of the opium, the pill at last contains nothing but wax."

For an account of the effects produced on English opium-eaters I may refer to the well-known confessions of Mr. De Quincey[1] and of the late Mr. S. T. Coleridge.[2] Numerous instances of the enormous quantities of opium which, by habit, may be taken with impunity, have been published. Dr. Chapman[3] tells us that he knew a wine-glassful of laudanum to be given several times in the twenty-four hours. "But what is still more extraordinary," says this author, "in a case of cancer of the uterus, which was under the care of two highly respectable physicians (Drs. Monges and La Roche) of Philadelphia, the quantity of laudanum was gradually increased to three pints, besides a considerable quantity of solid opium in the same period." Pinel mentions a lady who required 120 grains of opium to give her ease in cancer of the uterus.

Some doubt has been entertained as to the alleged injurious effects of opium-eating on the health, and its tendency to shorten life; and it must be confessed that in several known cases which have occurred in this country no ill effects have been observable. Dr. Christison[4] has given abstracts of eleven cases, the general result of whose histories "would rather tend to throw doubt over the popular opinion." A few years ago, a Life-Assurance Company, acting on this general opinion, resisted payment of a sum of money, on the ground that the insurer (the late Earl of Mar) had concealed from them a habit which tends to shorten life. But the case was ultimately compromised. Dr. Burnes[5] asserts that the natives of Cutch do not suffer much from opium-eating.

In those cases of disease (usually cancerous) in which enormous doses of opium are taken to alleviate pain, I have usually observed constipation produced; but Dr. Christison says, "constipation is by no means a general effect of the continued use of opium. In some of the cases mentioned above, no laxatives have been required; in others, a gentle laxative once a week is sufficient."

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[1] *Confessions of an English Opium-eater.*

[2] Cottle's *Early Recollect. of the late S. T. Coleridge*, vol. ii. p. 149, et seq. Lond. 1837.

[3] *Elem. of Therap.* ii. 199.

[4] *Treat. on Poisons.*

[5] *Sketch of Hist. of Cutch*, p. 9, Edinb. 1839.

In 1841 an opium-eater aged 26, was admitted into the London Hospital. He was accustomed to take two or two and a half drachms of solid opium daily. He originally began its use to relieve the attacks of angina pectoris. He was now most anxious to leave off this habit; though the difficulty of doing so was extreme. It did not diminish, but, according to his assertion, augmented his appetite; for, after each dose, he ate voraciously. At first when he commenced its use it caused dryness of the mouth and throat, and constipation, but latterly his bowels were regular as before he commenced the use of this drug. His pulse ranged from 88 to 96. His urine was somewhat less than natural. The condition of his skin varied; in general it was dry, but occasionally was covered with profuse perspiration. He described the effect of the opium on his mental faculties as those of calmness, comfort, and serenity. Under its use he was able to support great bodily and mental fatigue. He never experienced the exhilarating and pleasurable sensations described by De Quincey. His feelings, when not under the influence of opium, were most distressing. Mr. Davies (an intelligent pupil) described his condition at this time as follows:—eyes hollow, dark, and sunken; features haggard; hands trembling; voice and manner anxious; mouth parched; appetite wanting; sleeplessness. Unable to sleep for want of his accustomed dose, he used to pace the ward of the hospital at night almost frantic, though quite sensible of his miserable condition, and anxious to abandon the practice.

[There is great reason to believe that the practice of opium-eating is very common in this country among the lower as well as the middle classes. The consumption of opium is very great, and wholly disproportioned to the quantity required for medicinal purposes. From an official report published in July 1853, it appears that in the five months preceding that date the enormous quantity of 63,354lb. of opium had been imported into this country; the quantity for one month was 9,699lb.—ED.]

Opium-smoking.—I have already referred to the enormous quantities of opium consumed in China and the islands of the Indian Archipelago by smoking. The *smokeable extract*, called *chandoo*, is made into pills about the size of a pea. "One of these being put into the small tube that projects from the side of the opium-pipe, that tube is applied to a lamp, and the pill being lighted, is consumed at one whiff or inflation of the lungs, attended with a whistling noise. The smoke is never emitted by the mouth, but usually receives vent through the nostrils, and sometimes, by adepts, through the passage of the ears and eyes."[1] The residue in the pipe is called *Tyechandoo*, or fæcal opium, and is used by poor persons and servants.

The mode of using the pipe has been depicted by Mr. Davies.[2] Some details respecting the mode of smoking opium have been given by Dr. Hill.[3]

In the first edition of this work I stated that although the immoderate practice of opium-smoking must be highly detrimental to health, yet that I believed the statements of Medhurst[4] and others applied to cases in which this practice was carried to excess; and I observed that an account of the effects of opium-smoking by an unbiassed and professional witness was a desideratum. My opinion was founded on the statements of Botta[5] and Marsden.[1] The latter, a most accurate writer, observes that "the *Limun* and *Batang Assei* gold-traders, who are an active and laborious class of men, but yet indulge as freely in opium as any others whatever, are, notwithstanding, the most healthy and vigorous people to be met with on the island." This desideratum has been supplied by Mr. Smith,[2] surgeon, of Pulo Penang, whose statements fully confirm my opinion. For although the practice is most destructive to those who live in poverty and distress, and who carry it to excess, yet it does not appear that the Chinese, in easy circumstances, and who have the comforts of life about them, are materially affected, in respect to longevity, by the private addiction to this vice. "There are many persons," observes Mr. Smith, "within my own observation, who have attained the age of sixty, seventy, or more, and who are well known as habitual opium-smokers for more than thirty years past." The first effect of this drug on the Chinese smokers is to render them more loquacious and animated. Gradually the conversation drops, laughter is occasionally produced by the most trifling causes, and to these effects succeed vacancy of countenance, pallor, shrinking of the features, so that the smokers resemble people convalescing from fever, followed by deep sleep for half an hour to three or four hours. An inordinate quantity causes headache, vertigo, and nausea. The Malays are rendered outrageous and quarrelsome by the opium-pipe.

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[1] Marsden, *Hist. of Sumatra*, 3rd ed. p. 278.

[2] *The Chinese*, vol. ii. p. 459.

[3] *The Times* newspaper for Dec. 3rd, 1841.

[4] *China* 1838.

[5] Froriep's *Notizen*, xxvi.

It is extremely difficult to discontinue the vice of opium-smoking, yet there are many instances of its being done. The continuance of this destructive practice deteriorates the physical constitution and moral character of the individual, especially among the lower classes. Its powerful effects on the system are manifested by stupor, forgetfulness, deterioration of the mental faculties, emaciation, debility, sallow complexion, lividity of lips and eyelids, languor and lacklustre of the eye, appetite either destroyed or depraved, sweetmeats or sugar-cane being the articles that are most relished. "In the morning these creatures have a most wretched appearance, evincing no symptoms of being refreshed or invigorated by sleep, however profound. There is a remarkable dryness or burning in the throat, which urges them to repeat the opium-smoking, If the dose be not taken at the usual time, there is great prostration, vertigo, torpor, discharge of water from the eyes, and in some an involuntary discharge of semen, even when wide awake. If the privation be complete, a still more formidable train of phenomena takes place. Coldness is felt over the whole body, with aching pains in all parts. Diarrhœa occurs; the most horrid feelings of wretchedness come on; and, if the poison be withheld, death terminates the victim's existence." The offspring of opium-smokers are weak, stunted, and decrepit.

[Dr. Eatwell's paper on opium contains some remarks on the subject of opium-smoking, which we here subjoin.—ED.]

"It has been too much the practice with narrators who have treated on the subject, to content themselves with drawing the sad picture of the confirmed opium debauchee, plunged in the last state of moral and physical exhaustion, and having formed the premises of their argument from this exception, to proceed at once to involve the whole practice in one sweeping condemnation. But this is not the way in which the subject can be treated; as rational would it be to paint the horrors of delirium tremens, and upon that evidence to condemn at once the entire use of alcoholic liquors. The question for determination is not what are the effects of opium used to excess, but what are its effects on the moral and physical constitution of the mass of the individuals who use it habitually, and in *moderation*, either as a stimulant, to sustain the frame under fatigue, or as a restorative and sedative after labour, bodily or mental. Having passed three years in China, I may be allowed to state the results of my observation; and I can affirm thus far, that the effects of the abuse of the drug do not come very frequently under observation, and that when cases do occur the habit is very frequently found to have been induced by the presence of some painful chronic disease, to escape from the sufferings of which the patient has fled to this resource. That this is not always the cause, however, I am perfectly ready to admit, and there are, doubtless, many who indulge in the habit to a pernicious extent, led by the same morbid impulses which induce men to become drunkards in even the most civilised countries; but these cases do not at all events come before the public eye. It requires no laborious research in civilised England to discover evidences of the pernicious effects of the abuse of alcoholic liquors; our open and thronged gin palaces, and our streets, afford abundant testimony on the subject; but in China this open evidence of the evil effects of opium is at least wanting. As regards the effects of the habitual use of the drug on the *mass* of the people, I must affirm that no injurious results are visible. The people generally are a muscular and well-formed race, the labouring portion being capable of great and prolonged exertion under a fierce sun, in an unhealthy climate. Their disposition is cheerful and peaceable, and quarrels and brawls are rarely heard amongst even the lower orders; whilst in general intelligence they rank deservedly high amongst orientals. Proofs are still wanting to show that the moderate use of opium produces more pernicious effects upon the constitution than the moderate use of spirituous liquors, whilst at the same time it is certain that the consequences of the abuse of the former are less appalling in their effect upon the victim, and less disastrous to society at large, than the consequences of the abuse of the latter. Compare the furious madman, the subject of delirium tremens, with the prostrate debauchee, the victim of opium; the violent drunkard with the dreaming sensualist intoxicated with opium; the latter is at least harmless to all except to his wretched self, whilst the former is but too frequently a dangerous nuisance, and an openly bad example to the community at large."

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[1] *Op. supra cit.* p. 278.

[2] *Lancet*, February 19, 1842.

4. *Action of Opium on the different organs.*—In discussing this subject, it will be convenient to consider the organs arranged in groups or systems devoted to some common functions.

a. On the Cerebro-spinal system.—Taken in small or moderate doses, opium first produces excitement of the vascular system of the brain, accompanied with corresponding excitement in the cerebro-spinal functions, as already stated. This state, however, is succeeded by that of depression. The effect of opium-eating and opium-smoking on the intellectual faculties has been already described. In large or poisonous doses the leading symptom is sopor; that is, a state analogous to profound sleep, from which the patient *can* be roused, though with difficulty. In the latter stage of poisoning this symptom is succeeded by coma—that is, profound sleep, from which the patient *cannot* be roused. Sopor is usually accompanied either with actual paralysis of the muscular fibres, or with a diminished power almost amounting to it; both of which states doubtless arise from the same condition of the cerebro-spinal system which produces sopor or coma. This state is usually supposed to be sanguineous (venous) congestion. The pupil is usually contracted,—a circumstance deserving of especial notice. In some cases there is delirium in the place of sopor or coma, and convulsions instead of paralysis. These are to be regarded as exceptions to the general rule, and are accounted for, pathologically, by supposing that they depend on a state of irritation or excitement set up in the nervous centres, and which usually, though not invariably, terminates in congestion. Another effect of opium is diminished sensibility. Thus the whole body becomes less susceptible of painful impressions; in dangerous and fatal cases, the eyes are insensible to light,—the ears to sound. This state has been accounted for by supposing that the functions of the sensitive nerves are diminished or suspended by the congested condition of the brain.

From these effects of opium on the cerebro-spinal system the following inferences may be drawn: —

1. That it is an objectionable agent in apoplexy, phrenitis, paralysis, and in some forms of hysteria.[1]

2. That under proper regulations it is a remedy which may be used to stimulate the cerebro-vascular system, to promote sleep, to diminish inordinate muscular contraction, to diminish the sensibility of the body, and thereby to alleviate pain.

β. On the Digestive System.—The usual effects of opium on the organs of digestion are the following: — It diminishes secretion and exhalation from the whole canal; thus it causes dryness of the mouth and throat, and diminishes the liquidity of the stools: it excites thirst, lessens hunger, checks the digestive process (for in some animals poisoned by opium, food which they had taken previously has been found in the stomach unchanged);[2] and in some cases it excites vomiting. Mr. Kerr[3] tells us, that in the famine which prevailed in the East Indies in the year 1770, opium was purchased by the unhappy sufferers, at extraordinary prices, to allay the cravings of hunger, and to banish the dreadful prospect of death. The Tartar couriers, who travel immense distances in a short period of time, take opium only during the journey, to support them. It diminishes the sensibility and contractility of the digestive organs: hence the difficulty, in severe cases of poisoning, of producing vomiting. The constipation which follows the use of opium depends partly on the same cause, and in part also on the diminished excretion of bile, and diminished secretion from the gastro-intestinal mucous membrane. Sprœgel[4] found the choledic ducts of animals, to which opium had been given, filled with bile; yet it had not passed into the intestines, for the fæces were scarcely tinged by it, but had the same appearance which we observe them to have in jaundiced patients.

From these effects of opium on the digestive organs, we may draw the following inferences: —

1. That in diminished secretion from the gastro-intestinal membrane, in extreme thirst, in loss of appetite and weak digestion, in obstinate costiveness, and in diminished excretion of bile, opium is an objectionable remedy.

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[1] I have seen, in two cases, serious effects follow the use of small doses of opium in hysteria. Both patients were females at or about the age of twenty, weak and thin, and subject to hysteria. In the first there was insensibility apparently of an hysterical kind. The patient had several fits. On her recovery from these she complained of headache, and there was great irritability. Only one grain of opium was administered, but this caused sopor and death.

[2] [In a case of poisoning by opium, in which a female remained eighteen hours in a state of insensibility, we found the farinaceous food still unchanged in the stomach.—ED.]

[3] *Med. Obs. and Inq.* vol. v. p. 321.

[4] Quoted by Christien, *Opium Hist. Chem. and Pharm. Invest.* p. 66, 1820.

2. That under proper regulations opium is an admissible remedy for the following purposes:—To diminish excessive hunger; to allay pain, when unaccompanied by inflammation; to diminish the sensibility of the digestive organs, in cases of acrid poisoning, and in the passage of biliary calculi; to produce relaxation of the muscular fibres of the alimentary canal (in colic and diarrhœa), and of the gall ducts (in the passage of calculi), and to diminish excessive secretion from the intestinal canal, in diarrhœa.

By continued use (as by opium-eaters) this drug frequently ceases to cause dryness of the mouth, to pall the appetite, or to confine the bowels.

γ. *On the Vascular System.*—Opium certainly influences the movements of the heart and arteries; but the effect is by no means uniform, since in some cases we see the pulse increased, in others diminished in frequency; and a like variation is noticed in its fulness. Moreover, these variations occur in the same case at different stages. From Dr. Crumpe's experiments, before referred to, it appears that, after the use of a moderate dose of opium, the frequency of the pulse is first increased, then decreased. The diameter of the artery, and the force and regularity with which the pulsations are effected, are properties of the pulse, readily, but by no means uniformly, affected by opium. To a certain extent we perceive a relation between the condition of the pulse and that of the cerebro-spinal functions. Thus, when convulsions occur, we usually have a hurried pulse,—whereas when sopor or coma supervenes, the pulse becomes weaker or slower, or both, than natural. But these conditions are by no means uniform. A frequent pulse, with a feverish condition of the body, are common consequences of the use of small or moderate doses of opium; and in poisoning by this drug, a quick pulse, even though no convulsive movements are observed, is by no means rare. A poisonous dose of opium usually enfeebles the pulse, sometimes makes it fuller, often renders it irregular, and towards death always renders it feeble, and often imperceptible. We can easily believe that the muscular fibres of the heart must experience, from the use of a large dose of opium, a diminution of power in common with other muscular fibres, and hence the contractions become weaker. It is also probable that the contractile coat of the arteries and capillaries equally suffers. Now Wirtensohn[1] supposes that the fulness of the pulse sometimes observed in poisoning by opium, arises from the insufficient power of the heart to propel the blood through this paralysed or weakened capillary system. The accumulation of blood observed in the large venous trunks and cavities of the right side of the heart is supposed to arise from the obstruction experienced to its passage through the pulmonary vessels.

In attempting to lay down indications and contra-indications for the use of opium as a remedy for morbid conditions of the circulation, two difficulties present themselves:—*first*, the same condition of the vascular system may be induced by various and even opposite causes, for some of which opium may be an appropriate remedy, while for others it may prove an injurious agent; *secondly*, the effects of opium on the circulation are not uniform, and hence not to be relied on. The following conclusions, therefore, are submitted with considerable hesitation as to the universality of their application:—

1. That in increased activity of the vascular system with considerable power, or with diminished secretions and exhalations, and in morbid conditions of the vascular system with a tendency to sopor or coma, opium is an objectionable remedy.

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[1] Quoted by Barbier, *Traité Elém. de Mat. Méd.* t. ii. 2me éd.

2. That in vascular excitement with great diminution of power, as after hemorrhage, and in various morbid conditions of the pulse attended with acute pain, spasm, or profuse secretion and exhalation, but without visceral inflammation, opium often proves a serviceable agent.

δ. *On the Respiratory System.*—In studying the effects of opium on the respiration, we must remember that the mechanical part of this function is effected by muscular agency; and as the contractility of the muscular fibre is powerfully influenced by opium, so the respiratory movements are also necessarily modified. Occasionally the primary effect is a slight increase in their frequency; but the secondary effect is almost always of an opposite kind, the respiration being slower than usual; and when coma is present, the breathing is usually gentle, so as scarcely to be perceived; but in some cases it is stertorous. In fact, a paralytic condition of the respiratory muscles takes place, in consequence of which inspiration becomes gradually more and more difficult, until eventually asphyxia is induced, which is usually the immediate cause of death. Another effect ascribed to opium is, that it checks the arterialisation of the blood, by diminishing the supply of nervous agency, without which the decarbonisation or oxygenisation of this fluid cannot take place. It is difficult, however, to distinguish the consequences of this effect from those of asphyxia produced by paralysis of the respiratory muscles.

The third point of view under which we have to examine the influence of opium on the respiratory system is, its effect on the membrane lining the trachea and bronchial tubes and cells. In the first place it diminishes the sensibility of this, in common with other parts of the body; and, secondly, it checks exhalation and mucous secretion.

A knowledge of these effects of opium on the organs of respiration leads to the following conclusions:—

1. That this agent is contra-indicated in difficulty of breathing arising from a deficient supply of nervous energy, as in apoplectic cases; that it is improper where the venous is imperfectly converted into arterial blood; and, lastly, that it is improper in the first stage of catarrh and peripneumony, both from its checking secretion, and from its influence over the process of arterialisation.

2. That in cases of poisoning by opium, artificial respiration is indicated to prevent asphyxia.

3. That opium may, under proper regulations, be useful to diminish the contractility of the muscles of respiration, or of the muscular fibres of the air-tubes, as in spasmodic asthma; to diminish the sensibility of the bronchia, in the second stage of catarrh, and thereby to allay cough by lessening the influence of the cold air; and lastly, to counteract excessive bronchial secretion.

ε. *On the Urinary System.*—Authors are not agreed as to the effect of opium on the kidneys; some asserting that it increases, others that it diminishes, the quantity of urine secreted. Thus, Dr. Michaelis[1] asserts, that in giving opium in venereal cases, he has sometimes found the secretion of urine exceeding in quantity all the fluids drunk. It cannot, however, be doubted, that in most cases a moderate quantity of opium diminishes the excretion, while at the same time it makes this fluid turbid and thick. This does not, however, prove that the kidneys are the parts affected. Sprœgel[2] tells us, that when he gave two scruples of opium to dogs, no urine was passed for two days; and, under the influence of two drachms of this medicine, the urine was retained for three days. But dissection showed that the kidneys had not ceased to secrete urine, since the bladder was found distended with this secretion, and its parietes without the least sign of contractility on the application of nitric acid; so that it would appear that the non-evacuation of the urine was referable to the insensible and paralysed condition of the vesical coats, and not to the diminished urinary secretion. Charvet[1] has also noticed in dogs, cats, and hares, that the urinary bladder was distended. As, however, in man opium usually increases the cutaneous exhalation, while in other mammals this effect was not observed, we must be careful in transferring our conclusions with respect to the influence of opium on one order of animals to another order. But I ought to add, that Welper, of Berlin, always found the bladder filled with urine both in man and animals. In some morbid conditions of system, opium certainly checks the urinary secretion. This is decidedly the case in diabetes.[2]

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[1] *Med. Comm.* i. p. 307, 1784.

[2] Cited by Christien, *op. supra cit.* p. 68.

The ureters and bladder have their sensibility and contractility diminished by opium. With respect to the effect on the first of these parts the statement seems proved by the well-known beneficial influence of opium in cases where calculi are descending along these tubes. The acute pain is frequently relieved, and the ureters relaxed, so that large calculi are sometimes allowed to descend from the kidneys along them. Besides the observations of Sprœgel, before referred to, we have other evidence of the paralysing and benumbing effect of opium on the bladder. In some cases of poisoning by this substance the bladder has been found to be unable to contract on its contents. In some other instances the sphincter of the bladder has been paralysed, and in consequence the urine was voided involuntarily.[3] Barbier has also noticed the same thing, and quotes the experience of Dr. Bally to the same effect. The effect of morphia on the bladder is more marked than that of opium.

These remarks on the effects of opium on the urinary organs lead to the following conclusions:—

1. That in diminished sensibility or contractility, or both, of the ureters or bladder, the use of opium is objectionable.
2. That, under proper regulations, opium may be a valuable remedy to dull the sensibility of the pelvis of the kidney, in cases of renal calculi; to allay pain and produce relaxation of the ureters when calculi are passing along these tubes; and, lastly, to diminish irritation of the bladder, whether produced by cantharides or other causes.

ζ. *On the Sexual System.* αα. *Of Men.*—Opium has long been celebrated as an aphrodisiac; and we are told that the Japanese, Chinese, Indians, Persians, Egyptians and Turks, use it as such. Among other symptoms of excitement produced by the habitual use of large doses of opium, it is not improbable that there may be a heightened condition of the venereal feelings, in consequence of an increased determination of blood to that part of the brain supposed to be devoted to the sexual function, which part the phrenologists assert to be the cerebellum. Moreover it is said to produce erection; and in support of this statement the following strange story is told:—"Turcæ ad Levenzinum, 1664, contra Comitem Lud. Souches pugnantes, opio exaltati, turpiter cæsi et octo mille numero occisi mentulas rigidas tulere."[1] Cabanis[2] adopts this story, and ascribes the above-mentioned condition to the convulsive movements which affect the body *in articulo mortis*, and not to an aphrodisiac operation. The effect alluded to, if it really takes place, is probably to be referred to the accumulation of blood in the erectile tissues, arising from a disordered state of the circulation. Impotence is ascribed by some to opium-eating, and is a more probable effect. I am unacquainted with any facts on which to ground any well-founded opinion as to the power of opium to diminish or increase the spermatic secretion.

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[1] *Op. supra cit.* p. 221.

[2] Prout, *Inq. into the Nat. and Treat. of Affect. of the Urin. Org.* p. 74, 2nd ed.

[3] See *Lond. Med. and Phys. Journ.* xxviii. 80. xxxi. 193; and *Lond. Med. Rev.* for 1811. p. 371.

ββ. Of Women.—We have little positive information as to the effects of opium on the reproductive organs of women. It is said that the catamenia, lochia, and secretion of milk, are unaffected by it, but that it causes intumescence of the nipples. Under its use the milk acquires a narcotic property. Furthermore, at times it has appeared to have an injurious effect on the fœtus *in utero*.[3] Opium appears to act on the uterus as on most other contractile parts of the body; that is, it diminishes the contractility and sensibility of this viscus.

From these observations it follows:—

1. That wet nurses and pregnant women must employ opium with great caution, as its use by them may endanger the life of the child.
2. That opium may be employed to allay pain, spasm, and morbid irritation of the sexual organs in either sex; and that its use in the female is not likely to be attended with retention of the uterine or mammary secretions.
3. That the influence of opium on the venereal appetite is not sufficiently and satisfactorily determined to permit us to make any practical application of it.

η. On the Cutaneous System.—Considered as an organ of sense, the cutaneous system is affected by opium in an analogous way to the other organs of sense; that is, its sensibility is diminished. But the skin has another function—that of excretion, and which does not appear to be at all diminished, nay, to be increased, by the use of opium; one of the usual effects of this medicine being perspiration, which is in some cases attended with a pricking or itching of the skin, and occasionally with an eruption. In fact, taken medicinally, opium is a powerful sudorific, and often proves so even when acting as a poison. "In a fatal case, which I examined judicially," says Dr. Christison, "the sheets were completely soaked to a considerable distance round the body."[4]

From these remarks it follows:—

1. That opium is not likely to relieve loss of feeling or excessive perspiration; but may, on the other hand, under some conditions of the system, prove injurious.
2. That opium is adapted to the relief of pain or excessive sensibility of the skin,

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[1] Christien, *op. supra cit.* p. 53.

[2] *Rapp. de Phys. et du Morale de l'Homme.*

[3] F. H. Ramsbotham, *Lond. Med. Gaz.* vol. xiv. p. 84.

[4] [It has been supposed that the cutaneous secretion is one of the means by which the poison is eliminated. A friend informs us that in one case the perspiration had an opiate odour. This odour may, however, have proceeded from another source.—ED.]

and for provoking perspiration; but the propriety of its use for these purposes must be determined by reference to the condition of the system generally. Experience proves that when the skin is very hot, and especially if it be also dry, opium is seldom beneficial, but often hurtful.

θ. *Topical effects.*—The local effects of opium are, compared with the general effects, very slight. Applied to the eye, the internal membrane of the nose, urethra, cutis vera, wounds or ulcers, it first causes pain, a sense of heat, and inflammation; but these effects subside, and are followed by a weakened or a paralytic condition of the sensitive and motor nerves. Several physiologists have proved that opium causes a local paralysis of the nerves; and Müller[1] has shown that the narcotic action is not propagated from the trunk of a nerve to its branches. Crumpe[2] showed, that, at the end of thirty minutes, the eye to which opium had been applied was somewhat less susceptible of the action of alcohol. Scarcely any obvious effect results from the application of opium to the ordinary integument, on account of the barrier presented by the cuticle. Employed endermically the effects are much more powerful.

POST-MORTEM APPEARANCES.—The most important appearances are those observed in the nervous system; such as turgescence of vessels, effusion of water or of coagulable lymph, and occasionally, though rarely, extravasation of blood. Whenever redness of the digestive canal is observed, I believe it is referable to the use of some irritants (such as spirits, ammonia, or emetics) taken either with, or after the use of, opium.

MODUS OPERANDI.—Under this head I propose to examine several points not hitherto noticed, which involve the theory of the operation of opium on the system.

1. *The Odorous and Active Principles of Opium are absorbed.*—This assertion is proved by the following facts:—

α. The odour of opium is sometimes recognisable in the secretions and exhalations: thus it is well known that the opiate odour is frequently detected in the breath of persons poisoned by this drug; and Barbier[3] states, it may be also noticed in the urine and sweat. (See note 4, p. 630.)

β. The secretions, in some cases, appear to possess narcotic properties. Barbier mentions the case of an infant that was thrown into a state of narcotism of several hours' duration, in consequence of having been suckled by a nurse who had previously swallowed a dose of laudanum to relieve cramp of the stomach.

γ. Barruel asserts that he detected morphia in the blood and urine[4] of a person under the influence of a poisonous dose of laudanum. As, however, these results have not been obtained by Dublanc or Lassaigne, the statement is not to be absolutely relied on.

2. *The Constitutional Effects of Opium depend in great part, if not*

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[1] *Phys.* by Baly, vol. i. p. 630.

[2] *Op. supra cit.*

[3] *Traité Elém. de Mat. Méd.* ii. 732, 2de éd.

[4] On one occasion I at first supposed that I had detected morphia and meconic acid in the urine of a man poisoned by opium; for both nitric acid and the sesquisalts of iron gave a red colour to this secretion. I have since found, however, that the urine of healthy individuals often yields the same results! [Lithic acid and lithate of ammonia decompose iodic acid precisely like morphia. A chemist not aware of this, once affirmed that he had detected morphia in the urine, when none was present! Unless morphia can be obtained crystallised in an independent state, we cannot affirm that it is certainly present.—ED.]

wholly, on the absorption of its active principles.—The facts on which this assumption rests are:—

α. The active principles of opium are absorbed.

β. The constitutional effects of it are found to be proportionate to the absorbing powers of the part.

γ. The effect of opium, when thrown into the jugular vein, is similar to, though more powerful than, that produced by its application to other parts of the body.

δ. "The narcotic action does not react from a particular point of a nerve on the brain."[1]

3. *The Essential and Primary Operation of Opium is on the Nervous System (the Brain and Spinal Cord chiefly).*—This is proved by reference to the already-described effects of opium. An examination of them shows that—

α. The most important effects of opium are direct and obvious lesions of the nervous functions.

β. The other effects of opium appear, for the most part, to be secondary,—that is, they arise out of the nervous lesions just referred to.

4. *Opium acts on the Nervous System as an Alterative.*—There are but three kinds of changes, compatible with life, which medicines can effect in the vital actions of an organ,—viz., an increase, a diminution, or an alteration of activity. A change in the intensity or energy merely of the vital actions of the nervous system, would not give a satisfactory explanation of the effects of opium. We are obliged, therefore, to assume that opium changes the quality of the actions. This is what is meant by the term *alterative*.

The inquiry into the nature and kind of influence exercised by opium over the system, presents an extensive field for speculation and hypothesis. Galen[2] declared opium to be cold in the fourth degree, and his authority long prevailed in the schools. It was first opposed by the *iatro-chemists*, who declared opium to be of a hot nature.[3] Some, however, adopted a middle course, and asserted that it possessed both hot and cold particles.[4] The *iatro-mechanists* endeavoured to explain the operation of opium on mechanical principles. By some expansion, by others condensation, of the blood, was supposed to be produced by the mechanical properties of the opiate particles acting on the nerves.[5] Dr. Cullen[6] considered opium to be a sedative, and referred its effects to its power of "diminishing the mobility, and in a certain manner suspending the motion of the nervous fluid." Several later writers, Barbier[7] for example, also calls opium a sedative. Brown[8] declared it to be a stimulant, and his opinion has been adopted by Crumpe,[9] Murray,[10] and Dr. A. T. Thomson,[11] in this country, and of course by the continental Brunonians, as well as by the partisans of the Italian theory of contra-stimulus.[12] Fontana[13] ascribed the operation of opium to changes which it induces in the blood. Mayer[1] declared opium to be both stimulant and sedative,—viz., stimulant to the nerves and vascular system, but sedative to the muscles and digestive organs. Lastly, Orfila[2] asserts that "opium, employed in strong doses, ought not to be ranked among the narcotics or the stimulants; it exerts a peculiar mode of action which cannot be designated by any of the terms at this moment employed in the Materia Medica." These examples, selected out of many opinions, will be sufficient to prove how little is really known of the real action of opium; and I believe we shall save ourselves much time and useless speculation by at once confessing our ignorance on this point.

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[1] Müller, *Phys.* by Baly, i. 631.

[2] *De Simpl. Med. Facult.* lib. viii.

[3] Wedelius, *Opiologia*, cap. vi. p. 26, 1682.

[4] See Crumpe, *op. supra cit.* p. 91.

[5] See an account of these opinions by Tralles, *Usus Opii*, Sect. 1, 1757.

[6] *Mat. Med.* ii. 225.

[7] *Traité Elém. de Mat. Méd.* ii. 2nde éd.

[8] *Elementa Medicinæ.*

[9] *Op. supra cit.*

[10] *Syst. of Mat. Med. and Therap.* Edinb.

[11] *Elem. of Mat. and Therap.*

[12] See some remarks on the *modus operandi* of opium, by Mr. Ward, in the *Lond. Med. and Phys. Journ.* vols. vii. viii. & ix.

[13] *Treat. on the Venom of the Viper*, iii. 199.

5. *The operation of Opium, compared with that of other cerebrospinants or narcotics, is distinguished by both positive and negative characteristics.*— The symptoms constituting the *positive* characters, are relaxation or paralysis of the contractile tissues, a tendency to sleep or stupor, a contracted pupil, and constipation. The symptoms whose absence furnishes the *negative* characters, are tetanic convulsions, delirium or inebriation, dilated pupil, syncope, gastro-intestinal irritation, and topical numbness.

These are the general characteristics of the opiate medication. To some of them occasional, or perhaps frequent, exceptions exist. I have already pointed out the distinguishing effects of hyoscyamus, belladonna, and stramonium. The topical numbness caused by aconite distinguishes its operation from that of opium. Moreover, in three cases of poisoning by this substance, which came under my notice, there was no stupor. Tobacco and foxglove enfeeble the vascular system, causing syncope; and they also produce gastro-intestinal irritation. Furthermore, they have not that tendency to induce sleep which we observe after the use of opium. The speedy operation, short period of influence, and, usually, the presence of convulsions, distinguish the operation of hydrocyanic acid. Indian hemp induces a cataleptic state.[3] Vinous liquids cause their well-known peculiar inebriation. Their effects in small doses agree to a certain extent with those of small doses of opium; but they are not equally available as antispasmodics. The peculiarities of the operation of conia have been pointed out.

USES. — Opium is undoubtedly the most important and valuable remedy of the whole Materia Medica. For other medicines we have one or more substitutes; but for opium, none,—at least in the large majority of cases in which its peculiar and beneficial influence is required. Its good effects are not, as is the case with some valuable medicines, remote and contingent, but they are immediate, direct, and obvious; and its operation is not attended with pain or discomfort. Furthermore, it is applied, and with the greatest success, to the relief of maladies of every day's occurrence, some of which are attended with the most acute human suffering. These circumstances, with others not necessary here to enumerate, conspire to give to opium an interest not possessed by any other article of the Materia Medica. We employ it to fulfil various indications; some of which have been already noticed. Thus we exhibit it, under certain regulations, to mitigate pain, to allay spasm, to promote sleep, to relieve nervous restlessness, to produce perspiration, and to check profuse mucous discharges from the bronchial tubes and gastro-intestinal canal. But experience has proved its value in relieving some diseases in which not one of these indications can be at all times distinctly traced.

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[1] Quoted by Orfila, *Toxicol. Gén.*

[2] *Ibid.*

[3] See Dr. O'Shaughnessy, *On the Prep. of the Indian Hemp*, Calc. 1839.

1. *In Fevers.*—The consideration of the use of opium in fever presents peculiar difficulties. Though certain symptoms which occur in the course of this disease, are, under some circumstances, most advantageously treated by opium, yet, with one or more of these symptoms present, opium may, notwithstanding, be a very inappropriate remedy. The propriety or impropriety of its use, in such cases, must be determined by other circumstances, which, however, are exceedingly difficult to define and characterise. It should always be employed with great caution, giving it in small doses, and carefully watching its effects. The symptoms for which it has been resorted to are, *watchfulness, great restlessness, delirium, tremor,* and *diarrhœa.* When watchfulness and great restlessness are disproportionate, from first to last, to the disorder of the vascular system or of the constitution at large; or when these symptoms continue after excitement of the vascular system has been subdued by appropriate depletives, opium frequently proves a highly valuable remedy: nay, the safety of the patient often arises from its judicious employment.[1] The same remarks also apply to the employment of opium for the relief of delirium; but it may be added, that in patients who have been addicted to the use of spirituous liquors, the efficacy of opium in allaying delirium is greatest. Yet I have seen opium fail to relieve the delirium of fever, even when given apparently under favourable circumstances; and I have known opium restore the consciousness of a delirious patient, and yet the case has terminated fatally. If the skin be damp and the tongue moist, it rarely, I think, proves injurious. The absence, however, of these favourable conditions by no means precludes the employment of opium; but its efficacy is more doubtful. Dr. Holland[2] suggests that the condition of the pupil may serve as a guide in some doubtful cases;—where it is contracted, opium being contra-indicated. A similar suggestion with respect to the use of belladonna was made by Dr. Graves, to which I have offered some objections. When sopor or coma supervenes in fever, the use of opium generally proves injurious. The combination of opium and emetic tartar has been strongly recommended in fever with much cerebral disturbance, by Dr. Law,[3] and Dr. Graves.[4]

2. *In Inflammatory Diseases.*—Opium has long been regarded as an objectionable remedy in inflammation; but it is one we frequently resort to, either for the purpose of palliating particular symptoms, or even as a powerful auxiliary antiphlogistic remedy. The statement of Dr. Young,[5] "that opium was improper in all those diseases in which bleeding was necessary," is, therefore, by no means correct in a very considerable number of instances. The objects for which opium is usually exhibited in inflammatory diseases are to mitigate excessive pain, to allay spasm, to relieve great restlessness, to check excessive secretion, and to act as an antiphlogistic. In employing it as an anodyne, we are to bear in mind that it is applicable to those cases only in which the pain is dispro-

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[1] See some interesting observations on this subject, by Dr. P. M. Latham, *Lond. Med. Gaz.* vol. x. pp. 11, 12.

[2] *Med. Notes and Reflect.* p. 427, 2d ed. 1840.

[3] *Lond. Med. Gaz.* xviii. 538 and 694.

[4] *Ibid.* xx. 538.

[5] *Treatise on Opium,* p. 169, Lond. 1755.

portionate to the local vascular excitement; and even then it must be employed with considerable caution; for to "stupify the sensibility to pain, or to suspend any particular disorder of function, unless we can simultaneously lessen or remove the causes which create it, is often but to interpose a veil between our judgment and the impending danger."[1] As an antiphlogistic, it is best given in conjunction with calomel, as recommended by Dr. R. Hamilton, of Lynn.[2] The practice, however, does not prove equally successful in all forms of inflammation. It is best adapted for the disease when it affects membranous parts;[3] and is much less beneficial in inflammation of the parenchymatous structure of organs. In *gastritis* and *enteritis* the use of opium has been strongly recommended by the late Dr. Armstrong.[4] After bleeding the patient to syncope, a full opiate (as 80 or 100 drops of the tincture, or three grains of soft opium) is to be administered; and if the stomach reject it, we may give it by injection. It acts on the skin, induces quiet and refreshing sleep, and prevents what is called the hemorrhagic reaction. If the urgent symptoms return when the patient awakes, the same mode of treatment is to be followed, but combining calomel with the opium. A third venesection is seldom required. In *peritonitis*, the same plan of treatment is to be adopted; but warm moist applications are on no account to be omitted. Of the great value of opiates in *puerperal fever* abundant evidence has been adduced by Dr. Ferguson.[5] In *cystitis*, opium, preceded and accompanied by blood-letting and the warm bath, is a valuable remedy; it relieves the scalding pain, by diminishing the sensibility of this viscus to the presence of the urine, and also counteracts the spasmodic contractions. In *inflammation of the walls of the pelvis of the kidney, and also of the ureters*, especially when brought on by the presence of a calculus, opium is a most valuable remedy; it diminishes the sensibility of these parts, and prevents spasm: furthermore, it relaxes the ureters, and thereby facilitates the passage of the calculus. In *inflammation of the gall ducts*, produced by calculus, opium is likewise serviceable; but, as in the last-mentioned case, blood-letting and the warm bath should be employed simultaneously with it. In *inflammation of the mucous membranes*, attended with increased secretion, opium is a most valuable remedy. Thus, in *pulmonary catarrh*, when the first stage of the disease has passed by, and the mucous secretion is fully established, opium is frequently very beneficial: it diminishes the sensibility of the bronchial membrane to cold air, and thereby prevents cough. In severe forms of the disease, blood-letting ought to be premised. Given at the commencement of the disease, Dr. Holland[6] says that twenty or thirty drops of laudanum will often arrest it altogether. In *diarrhœa*, opium, in mild cases, is often sufficient of itself to cure the disease; it diminishes the increased muscular contractions and increased sensibility (thereby relieving pain), and at the same time checks excessive secretion. Aromatics and chalk are advantageously combined with it. In violent cases blood-letting should precede or accompany it. *Mild* or *English cholera*, the disease which has been so long known in this country, and which consists in irritation or inflammation of the mucous lining of the stomach, is generally most successfully treated by the use of opium: two or three doses will in slight cases, be sufficient to effect a cure. When opium fails, the hydrocyanic acid is occasionally most effective. In *dysentery*, opium has been found very serviceable: it is best given in combination with either ipecacuanha or calomel. I have already stated that in *inflammation of the parenchymatous tissues of organs* the use of opium is less frequently beneficial, but often injurious. Thus in *inflammation of the cerebral substance* it is highly objectionable, since it increases the determination of blood to the head, and disposes to coma. In *peripneumonia* it is for the most part injurious; partly by its increasing the febrile symptoms, partly by its diminishing the bronchial secretion, and probably also, by retarding the arterialisation of the blood, and thereby increasing the general disorder of system. It must be admitted, however, that there are circumstances under which its use, in this disease, is justifiable. Thus, in acute peripneumonia, when blood-letting has been carried as far as the safety of the patient will admit, but without the subsidence of the disease, I have seen the repeated use of opium and calomel of essential service. Again, in the advanced stages of pneumonic inflammation, when the difficulty of breathing has abated, opium is sometimes beneficially employed to allay painful cough, and produce sleep. In *inflammation of the substance of the liver*, opium is seldom beneficial: it checks the excretion, if not the secretion, of bile, and increases costiveness. In *rheumatism*, opium frequently evinces its happiest effects. In acute forms of the disease it is given in combination with calomel, as recommended by Dr. R. Hamilton,—blood-letting being usually premised. From half a grain to two grains of opium should be given at a dose. Dr. Hope[1] recommends gr. vij. or gr. x. of calomel to be combined with each dose of opium. It is not necessary, or even proper, in ordinary cases, to affect the mouth by the calomel; though to this statement exceptions exist. The use of mercury may even, in some cases, be objectionable; and in such, Dover's powder will be found the best form of exhibition. This plan of treatment is well adapted for the diffuse or fibrous form of acute rheumatism; but it does not prove equally successful in the synovial forms of the disease. It is also valuable in chronic rheumatism.

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[1] Holland, *op. supra cit.* p. 424.

[2] *Ed. Med. Comment.* ix. 191.

[3] See Brachet, *De l'Emploi de l'Opium dans les Phlegm. des Membr. muq. ser. et fibr.* 1828.

[4] *Transactions of the Association of Apothecaries*, 1823.

[5] *Essays on the most Important Diseases of Women*, Part i. 1839.

[6] *Op. supra cit.* p. 421.

3. *In diseases of the Brain and Spinal Cord.*—In some cerebrospinal diseases great benefit arises from the use of opium; while in other cases injury only can result from its employment. The latter effect is to be expected in inflammation of the brain, and in apoplectic cases. In other words, in those cerebral maladies obviously connected with, or dependent on, an excited condition of the vascular system of the brain, opium acts injuriously. But there are many disordered conditions of the cerebrospinal functions, the intensity of which bears no proportion to that of the derangement of the vascular system of the brain; and there are other deviations from the healthy functions in which no change in the cerebral

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[1] *Lond. Med. Gaz.* xix. 815.

circulation can be detected. In these cases opium or morphia frequently evinces its best effects. In *insanity* its value has been properly insisted on by Dr. Seymour.[1] He, as well as Messrs. Beverley and Phillips, employed the acetate of morphia. Its good effects were manifested rather in the low, desponding, or melancholic forms of the disease, than in the excited conditions; though I have seen great relief obtained in the latter form of the disease by full doses. Opium is sometimes employed by drunkards to relieve *intoxication.* I knew a medical man addicted to drinking, and who, for many years, was accustomed to take a large dose of laudanum whenever he was intoxicated and was called to see a patient. On one occasion, being more than ordinarily inebriated, he swallowed an excessive dose of laudanum, and died in a few hours of apoplexy.

In *delirium tremens* the efficacy of opium is almost universally admitted. Its effects, however, require to be carefully watched; for large doses of it, frequently repeated, sometimes hasten coma and other bad symptoms. If there be much fever, or evident marks of determination of blood to the head, it should be used with great caution, and ought to be preceded by loss of blood, cold applications to the head, and other antiphlogistic measures. Though opium is to be looked on as a chief remedy in this disease, yet it is not to be regarded as a specific. Dr. Law[2] speaks in high terms of its association with emetic tartar. I have before noticed the use of opium in alleviating some of the *cerebral symptoms which occur during fever.*

In *spasmodic and convulsive diseases* opium is a most important remedy. In *local spasms produced by topical irritants*, it is a most valuable agent, as I have already stated: for example, *in spasm of the gall ducts* or *of the ureters*, brought on by the presence of calculi; in *colic*, and in *painful spasmodic contractions of the bladder*, or *rectum*, or *uterus*. In *spasmodic stricture* opium is sometimes useful. In genuine *spasmodic asthma*, which probably depends on a spasmodic condition of the muscular fibres investing the bronchial tubes, a full dose of opium generally gives temporary relief; but the recurrence of the paroxysms is seldom influenced by opium. There are several reasons for believing that one effect of narcotics in dyspnœa is to diminish the necessity for respiration. Laennec[3] states, that when given to relieve the extreme dyspnœa of mucous catarrh, it frequently produces a speedy but temporary cessation of the disease; and if we explore the respiration by the stethoscope, we find it the same as during the paroxysm,—a proof that the benefit obtained consists simply in a diminution of the necessity for respiration. That the necessities of the system for atmospheric air vary at different periods, and from different circumstances, is sufficiently established by the experiments of Dr. Prout;[4] and it appears that they are diminished during sleep, at which time, according to Dr. Edwards,[5] the transpiration is increased. Moreover, the phenomena of hybernating animals also bear on this point; for during their state of torpidity or hybernation, their respiration is proportionally diminished.

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[1] *Lond. Med. Gaz.* vol. ix. p. 114; and *Med.-Chir. Trans.* vol. xix. p. 167.

[2] *Lond. Med. Gaz.* xviii. 538 and 694.

[3] *Treat. on the Diseases of the Chest*, by Forbes, pp. 77 and 99, 1827.

[4] *Ann. of Phil.* ii. 330; and iv. 331.

[5] *De l'Infl. des Agens Physiq.* p. 321, 1824.

In the *convulsive diseases* (*chorea*, *epilepsy*, and *tetanus*), opium has been used, but with variable success: in fact, the conditions of system under which these affections occur, may be, at different times, of an opposite nature, so that a remedy which is proper in one case is often improper in another. In *tetanus*, opium was at one time a favourite remedy, and is undoubtedly at times a remedy of considerable value. But it is remarkable that the susceptibility of the system to its influence is greatly diminished during tetanus. I have already referred to the enormous quantities which may at this time be taken with impunity. In 128 cases noticed by Mr. Curling,[1] opium in various forms, and in conjunction with other remedies, was employed in 84 cases; and of these, 45 recovered. Notwithstanding, however, the confidence of the profession in its efficacy is greatly diminished.

Lastly, opium occasionally proves serviceable in several forms of *headache*, especially after loss of blood. I have seen it give great relief in some cases of what are commonly termed nervous headaches; while in others, with apparently the same indications, it has proved injurious. Chomel[2] applied, with good effect, opium cerate to a blistered surface of the scalp, to relieve headache.

4. *In diseases of the chest.*—In some affections of the heart and of the organs of respiration opium is beneficial. I have already alluded to its employment in *catarrh*, *peripneumonia*, and *spasmodic asthma*. In the first of these maladies caution is often requisite in its use. "In an aged person, for example, suffering under *chronic bronchitis* or *catarrhal influenza*—and gasping, it may be, under the difficulties of cough and expectoration—an opiate, by suspending these very struggles, may become the cause of danger and death. The effort here is needed for the recovery of free respiration; and if suppressed too long, mucus accumulates in the bronchial cells, its extrication thence becomes impossible, and breathing ceases altogether."[3]

5. *In maladies of the digestive organs.*—I have already referred to the use of opium in *gastritis*, *enteritis*, *peritonitis*. *diarrhœa*, *dysentery*, *colic*, *the passage of gall-stones*, and *in hepatitis*. With respect to the use of opium *in hepatic affections*, I am disposed to think with Dr. Holland, that, with the exception of the painful passage of a gall-stone through the ducts, there is scarcely a complaint of the liver and its appendages "where opium may not be said to be hurtful, though occasionally and indirectly useful when combined with other means."[4] *In poisoning by acrid substances* opium is used with advantage to lessen the susceptibility of the alimentary canal, and thereby to diminish the violence of the operation of these local irritants. Cantharides, all the drastic purgatives, when taken in excessive doses (as elaterium, colocynth, gamboge, scammony, and croton oil or seeds), and *Arum maculatum*, may be mentioned

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[1] *Treat. on Tetanus*, p. 151, 1836.
[2] *Lond. Med. Gaz.* vol. i. p. 156.
[3] Holland, *op. supra cit.* p. 425.
[4] *Op. supra cit.* p. 429.

as examples of the substances alluded to. Besides the above-mentioned beneficial operation, opium allays the spasmodic contractions of the bowels, relieves pain, and checks inordinate secretion and exhalation.

In poisoning by corrosives (the strong mineral acids and alkalies, for example), opium diminishes the sensibility of the alimentary canal: it cannot, of course, alter the chemical influence of the poisons, but it may prove useful by allaying the consequences of inflammation. In poisoning by the preparations of arsenic, of lead, and of copper, opium is sometimes found useful. [It has been used in poisoning by strychnia. It has had, to a certain extent, the effect of masking the symptoms, but not of preventing the fatal action of the poison.—ED.]

6. *In maladies of the urino-genital apparatus* opium is a most valuable remedy. It mitigates pain, allays spasmodic action, checks copious mucous secretion, and diminishes irritation. Its use for one or more of these purposes in *nephritis, cystitis, the passage of urinary calculi,* and *spasmodic stricture,* has been already pointed out. *In irritable bladder* it is an invaluable remedy, especially in conjunction with liquor potassæ. *In irritation* and *various painful affections of the uterus,* and in *chordee,* the value of opium is well known. In the treatment of the *phosphatic diathesis* it is the only remedy that can be employed, according to Dr. Prout, to diminish the unnatural irritability of the system. Of all remedies for that hitherto intractable malady, *diabetes,* opium has been found to give the greatest relief.[1] Under its use the specific gravity, saccharine quality, and quantity of urine, have been diminished. It has not, however, hitherto succeeded in permanently curing this disease. Dr. Prout has also found it serviceable when there is an *excess of urea in the urine.*[2]

7. *As an anodyne.*—To relieve pain by dulling the sensibility of the body, opium is, of all substances, the most useful, and the most to be relied on for internal exhibition. We sometimes use it to alleviate the pain of inflammation, as already mentioned; to diminish spasm and the sensibility of the part in calculi of the gall ducts, in the ureters, and even when in the urinary bladder; to relieve pain in the various forms of scirrhus and carcinoma, in which diseases opium is our sheet-anchor; to allay the pain arising from the presence of foreign bodies in wounds; to prevent or relieve after-pains; to diminish the pain of menstruation; and, lastly, as an anodyne in neuralgia. As a *benumber* or *topical anodyne* it is greatly inferior to aconite. Hence in neuralgia the latter is much more successful than opium. (See *Aconitum.*)

8. In *hemorrhages.*—Opium is at times serviceable to obviate certain *ill effects of hemorrhages;* as when there is great irritability attended with a small and frequent pulse, and also to relieve that painful throbbing about the head so often observed after large evacuations of blood. In or immediately after *uterine hemorrhage* the use of opium has been objected to, on the ground that it might prevent the contraction of the womb; but where the employment of opium is otherwise indicated, this theoretical objection deserves no weight. In *bronchial hemorrhage* it is at times

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[1] See Prout, *Inq. into the Treat. of Diabetes.* &c. p. 74, 2nd ed. 1825.

[2] *Inq. into the Treat. of Diabetes,* &c. p. 54, 2nd ed. 1825.

a valuable remedy, and may be associated with acetate of lead (notwithstanding the chemical objections to the mixture) with good effect.

9. *In mortification.*—When mortification is attended with excessive pain, opium is resorted to. In that kind of mortification called *gangræna senilis,* which commences without any visible cause, by a small purple spot on the toes, heels, or other parts of the extremities, and which sometimes arises from an ossified condition of the arteries, Mr. Pott[1] strongly recommended opium, in conjunction with a stimulating plan of treatment, and experience has fully proved its great efficacy.

10. *In venereal diseases.*—Opium is frequently employed in venereal diseases to prevent the action of mercurials on the bowels during salivation; also to allay the pain of certain venereal sores, and venereal diseases of the bones. By some it has in addition been employed as an anti-venereal remedy; and according to Michaelis[2] and others, with success. Moreover, it is stated by Dr. Ananian, who practised at Constantinople, that those persons who were in the habit of taking opium rarely contracted the venereal disease. But opium possesses no specific anti-venereal powers.[3] It has appeared to me, on several occasions, to promote the healing of venereal sores.

11. In various forms of *ulcers* and in *granulating wounds,* the efficacy of opium has been satisfactorily established by Mr. Skey.[4] Richter,[5] and others,[6] had already noticed its good effects; but their statements had attracted little attention. Mr. Grant,[7] in 1785, pointed out the efficacy of opium in the treatment of foul ulcers, attended with a bad discharge, and much pain. He ascribed these symptoms to "morbid irritability," which the opium removed. Its use is prejudicial in ulcers attended with inflammation, in the florid or sanguineous temperament, and in childhood. But in the chronic or callous ulcer, in the so-called varicose ulcer, in recent ulcers (from wounds) in which granulation proceeds slowly, or in other cases, the efficacy of opium, administered in small doses (as ten drops of laudanum three times daily), is most manifest, especially in elderly persons, and in those whose constitutions have been debilitated by disease, labour, spirituous liquors, &c. It appears to promote the most genial warmth, to give energy to the extreme arteries, and thereby to maintain an equal balance of the circulation throughout every part of the body, and to animate the dormant energies of healthy action.

12. The *external application* of opium is comparatively but little resorted to, and for two reasons: in the first place, its topical effects are slight; and, secondly, its specific effects on the brain and general system are not readily produced through the skin. Aconite and belladonna greatly exceed opium in their topical effects. The following are some of the local uses of opium:—In *ophthalmia,* the wine of opium is

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[1] *Chir. Obs.* 1775.

[2] *Med. Communications,* vol. i.

[3] Pearson, *Observ. on the Effects of various Art. of the Mat. Med. in Lues Ven.* p. 57, 1800.

[4] *On a new Method of Treatment employed in the Cure of various forms of Ulcer and Granulating Wounds,* Lond. 1837.

[5] *Comm. Soc. Scient. Gött.* vol. xv.

[6] See Ploucquet's *Lit. Med.* iv. 214, 1809.

[7] *Lond. Med. Journ.* vi. 5, and 130.

dropped into the eye when there is excessive pain (see *Vinum Opii*). In *painful and foul sores*, opiates are used with occasional good effects. Mr. Grant[1] applied the tincture twice a-day, in an oatmeal poultice, to irritable sores. Opiate *frictions* have been employed as topical anodynes, and to affect the general system. Thus, in *chronic rheumatism and sprains*, the opium liniment proves a useful application. In *maniacal delirium*, as well as some other cerebral disorders, Mr. Ward[2] employed, with apparently beneficial effects, opiate frictions; for example, ℥ss. of opium, mixed with gr. iv. of camphor, ℈iv. of lard, and ʒj. of olive oil. In *neuralgic affections*, an opiate cerate, or finely powdered hydrochlorate of morphia, applied to a blistered surface, occasionally gives relief. In *gastrodynia*, it may be applied in the same way to the epigastrium (Holland). In *gonorrhœa and gleet*, opium injections have been used. In *spasmodic stricture*, *diseases of the prostate gland*, and in *gonorrhœa to prevent chordee*, an opiate suppository is a useful form of employing opium, especially where it is apt to disagree with the stomach. In *nervous and spasmodic affections* (as some forms of asthma), the endermic application of opium or morphia, applied along the course of the spine, is often singularly beneficial, when all methods of depletion and counter-irritation have proved utterly unavailing (Holland). In *tooth-ache*, opium is applied to the hollow of a carious tooth. Dr. Bow[3] speaks in the highest terms of the efficacy of the external application of opium *in inflammatory diseases*, but especially *bronchitis* and *croup*.

ADMINISTRATION.—Opium is given, *in substance*, in the form of pill, powder, lozenge, or electuary. The dose is subject to great variation, depending on the age and habits of the patient, the nature of the disease, and the particular object for which we wish to employ it. In a general way, we consider from an eighth of a grain to half a grain a *small dose* for an adult. We give it to this extent in persons unaccustomed to its use, when we require its stimulant effects, and in mild catarrhs and diarrhœas. From half a grain to two grains we term a *medium dose*, and employ it in this quantity as an ordinary anodyne and soporific. From two to five grains we denominate a *full* or *large dose*, and give it to relieve excessive pain, violent spasm, in some inflammatory diseases after bloodletting, in tetanus, &c. These are by no means to be regarded as the limits of the use of opium. *Opium pills* (*pilulæ opii*) may be prepared either with crude or powdered opium. The latter has the advantage of a more speedy operation, in consequence of its more ready solution in the gastric secretions. Employed as a *suppository*, opium is used in larger doses than when given by the stomach. Five grains, made into a cylindrical mass with soap, may be introduced into the rectum, to allay irritation in the urino-genital organs. [We have known this dose to produce marked symptoms of poisoning in a person unaccustomed to the drug.—ED.]

ANTIDOTES.—In a case of poisoning by opium, the first indication is to remove the poison from the stomach, the second is to neutralise any of it which may be retained in the system, and the third is to obviate its injurious effects.

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[1] *Op. supra cit.*

[2] *Med. and Phys. Journ.* vol. i. p. 440, 1799.

[3] *Lancet*, March 18, 1837.

1. **Use of Evacuants.**—Until other and more powerful evacuant means can be obtained, we should have recourse to tickling the throat with the fingers, or with a feather dipped in oil. As domestic emetics, mustard or salt may be exhibited. A dessert-spoonful of flour of mustard, or a table-spoonful of salt, may be taken, stirred up in a tumblerful of water. The stomach-pump is, however, the best means of evacuating the contents of the stomach, and when it can be procured, should always be preferred. The emetics usually resorted to are the sulphates of zinc and copper: the first is preferred. It should be given in doses of from one to two scruples. The dose of sulphate of copper is less,—from five grains to fifteen. Ipecacuanha or tartar emetic may be resorted to when the other means are not at hand. Clysters containing fifteen or twenty grains of tartar emetic may be administered; or, in extreme cases, a solution of one or two grains of this salt may be injected into the veins, taking care to prevent the introduction of air.

2. **Use of Chemical Antidotes.**—There are no known agents which completely destroy the activity of opium by their chemical properties, and which can be resorted to in these cases. Infusion of galls, however, is regarded as the best, though an imperfect antidote. Magnesia, as well as iodine and chlorine, have also been recommended.

3. **Use of Therapeutical Means to obviate the Effects.**—The following are the principal means which have been found efficacious:—

a. Rousing the patient, by exercising him up and down the room between two men. It may sometimes be necessary to continue this for several hours.—*β. Cold affusion.* Cold water dashed over the head and chest is an exceedingly valuable agent. It often assists the operation of emetics. Dr. Boisragon[1] recommends the alternation of impression, with hot or cold water, and at different parts of the surface of the body.—*γ. Irritants.* The application of irritants to the body is also sometimes a useful practice: thus blisters and sinapisms to the feet.—*δ. Venesection.* Blood-letting is sometimes necessary; but it can be safely practised only after the opium has been withdrawn from the stomach. Orfila says, that under these circumstances it never increases, but in most cases materially relieves the symptoms.—*ε. Stimulants.* Ammonia, camphor, musk, strong coffee, and other stimulants, are sometimes used with advantage.—*ζ. Vegetable acids.* Orfila has found the vegetable acids to be the best anti-narcotics. For this purpose, drinks of vinegar and water, lemon juice, or cream of tartar and water, should be given every ten minutes. These agents, however, should not be resorted to till the poison has been evacuated from the stomach.—*η. Artificial respiration.* As a last resource this is on no account to be omitted. Death has on several occasions been apparently averted by it. An interesting case, in which it was successfully practised, was published many years ago by Mr. Whately.[2] Natural respiration was extinct when it was begun. In another successful case, related by Mr. Smith,[3] artificial respiration was kept up for four hours and a half (with an interval of an hour). When it was commenced there was no pulse at the wrist, and only a slight irregular action of the heart, indicative that life was not quite extinct. A third case, also successful, is that of an infant ten days old, which had taken twenty-five or thirty drops of laudanum intended for the mother, and had lost the power of deglutition, was comatose, and had several convulsions. Artificial respiration was sustained for two or three hours.[1]—[*θ. Electricity* and electro-magnetism have also been successfully employed of late years in several cases of poisoning by opium. This agent has been found effectual in keeping roused, children that are labouring under the effects of narcotic poison.—ED.]

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[1] *Lond. Med. Gaz.* March 6, 1840.

[2] *Med. Obs. and Inq.* vi. 331.

[3] *Med.-Chir. Trans.* xx. 86.

PREPARATIONS.—In noticing the preparations of the poppy employed in medicine, I shall arrange them under three heads:—1st, Preparations of poppy heads; 2dly, Of opium; 3dly, Of morphia.

a. *Preparations of Poppy-heads.*

1. DECOCTUM PAPAVERIS, L. E. D.; *Decoction of Poppy; Poppy Fomentation.* (Poppy-heads, sliced, ℥iv.; Water, Oiv. [Oiij. *E. D.*] Boil for a quarter of an hour [ten minutes, *D.*], and strain.)—The seeds contribute, by their oleaginous properties, to the emollient quality of the decoction. This preparation forms a common fomentation, which is applied to bruised, inflamed, excoriated, tender, or swollen parts; to the eye in ophthalmia, to the abdomen in enteritis, peritonitis, to tender ulcers, &c. In cancer and other painful affections of the uterus, it is thrown into the vagina as a soothing remedy.

2. SYRUPUS PAPAVERIS, L. E.; *Syrup of White Poppies.* (Poppy-heads, without the seeds, lb. iij. [lb. iss. *E.*]; Sugar [pure, *E.*], lb. v. [lb. iij. *E.*]; Boiling Water, *Cong.* v. [Oxv. *E.*]; [Rectified Spirit, ℥v. *L.*] Boil down the capsules in the water to two gallons, and strongly express the liquor. Again boil down the strained liquor to four pints, and filter while hot. Set it by for twelve hours that the dregs may subside; then boil down the clear liquid to two pints, add the sugar and dissolve it; lastly, mix in the spirit, *L.*—The *Edinburgh Pharmacopœia* directs the poppy-heads to be first macerated in water for twelve hours; then to boil down to five pints, and strain and express strongly through calico. Again to boil down to Oiiss., add the sugar, and dissolve with the aid of heat.[2])

Syrup of poppies, especially if too thin, is very liable to ferment, and then contains spirit or acetic acid, or both, and is of course ill adapted for medicinal use. To check these changes, it should be carefully made with spirit, according to the directions of the London College, taking care that it has the proper consistence, and keeping it in a cool place. Occasionally a mixture of treacle and laudanum, or of syrup and extract of poppies, has been substituted; but this fraud is highly dangerous, and has on several occasions proved fatal to children.[3] Syrup of poppies is narcotic, sedative, and anodyne, and is commonly employed as the infant's opiate. It mitigates pain, allays spasm and troublesome cough, and promotes sleep. Even in the adult it is sometimes used for these purposes. It forms a useful adjunct to pectoral tinctures. Over ordinary opiates it has the positive advantage of a less disagreeable taste, and the supposed one of being less likely to create nausea and headache. Even when properly prepared, its administration to infants requires the greatest caution, on account of their known susceptibility to the influence of opiates. "I have been informed," says Dr. Montgomery, "of more than one instance in which a tea-spoonful has been known to prove fatal to a healthy child."—The dose of it, for an infant of three or four months old, is fʒss.; for adults, from fʒij. to fʒiv.

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[1] *United States Dispensatory.*

[2] [Messrs. T. and H. Smith of Edinburgh have given another formula for the preparation of this syrup, for which we must refer the reader to the *Pharmaceutical Journal*, vol. xii. p. 283.—ED.]

[3] See the cases referred to by Dr. Montgomery, in his *Obs. on the Dublin Pharm.* 472.

3. EXTRACTUM PAPAVERIS, L. E.; *Extract of Poppy.* (Poppy-heads, without the seeds, bruised, ℥xv.; Boiling [distilled, *L.*] Water, *Cong.* j. Macerate for twenty-four hours; then boil down to four pints, and filter the liquor while hot; lastly, evaporate to a proper consistence [by the vapour-bath, *E.*])—Anodyne and soporific. It appears to me to produce effects similar to those of opium, for which it is frequently substituted, on the supposition that, while it allays pain and promotes sleep, it is less liable to occasion nausea, constipation, headache, or delirium. If it be prepared from a decoction, instead of an infusion of poppy-heads as directed in the Pharmacopœias, it will contain a considerable quantity of inert mucilaginous matter.—Dose, gr. ij. to ℈j.

b. *Preparations of Opium.*

[**1. AQUA OPII DESTILLATA,** *Pharm. Norveg.; Distilled Water of Opium.* Take of powdered Opium, one part; Water, ten parts. Distil six parts into a properly closed receiver.—ED.]

2. PILULÆ OPII *sive* **THEBAICÆ,** E.; *Opium Pills.* (Opium, *one part;* Sulphate of Potash, *three parts;* Conserve of Red Roses, *one part.* Beat them into a proper mass, which is to be divided into five-grain pills.—It is to be observed that this pill contains twice as much opium as the opiate pill of the last Latin edition of this Pharmacopœia, *E.*)—Employed as an anodyne and soporific.—Dose, one or two pills (*i. e.* gr. v. to gr. x.) The sulphate of potash serves to divide the opium. One pill of five grains contains one grain of opium.

3. PILULÆ SAPONIS COMPOSITÆ, L. D.; *Compound Soap Pills.* (Opium, powdered; Liquorice, powdered, each ʒij.; Soft Soap, ʒvj. Beat them together until incorporated, *L.*—Opium, in fine powder, ℥ss.; Castile Soap, ℥ij.; Distilled Water, ʒss., or as much as is sufficient. Reduce the soap to a fine powder, add the opium and water, and beat the mixture into a mass of an uniform consistence, *D.*)—Employed as an anodyne and soporific.—Dose, gr. iij. to gr. x. Five grains contain one grain of opium. The soap enables the pills to dissolve readily in the juices of the stomach. From gr. v. to ℈j. are sometimes used as a suppository.

4. PILULÆ CALOMELANOS ET OPII, E. (See Vol. I. p. 928.)

5. PILULÆ PLUMBI OPIATÆ, E. (See Vol. I. p. 808.)

6. TROCHISCI OPII, E.; *Opium Lozenges.* (Opium, ʒij.; Tincture of Tolu, ℥ss.; Pure Sugar, in fine powder, ℥vj.; Powder of Gum-Arabic, and Extract of Liquorice, softened with boiling water, of each ℥v. Reduce the opium to a fluid extract by the formula [given for extract of opium]; mix it intimately with the liquorice previously reduced to the consistence of treacle; add the tincture; sprinkle the gum and sugar into the mixture, and beat it into a proper mass, which is to be divided into lozenges of ten grains).—In London the manufacture of lozenges is practised as a distinct trade. The opium lozenges of the shops usually contain each about one-eighth of a grain of opium. Lozenge-makers employ a much smaller proportion of gum. The tincture of tolu, which they use, is much more concentrated than that of the shops, the spirit of which is objectionable. Opium lozenges are used to allay troublesome cough.

7. PULVIS CRETÆ COMPOSITUS CUM OPIO, L.; *Pulvis Cretæ Opiatus*, E. D.; *Compound Powder of Chalk with Opium.* (Compound Powder of Chalk, ℥viss. [℥vj. *E.*; ℥iv. ʒvij. *D.*]; Powder of Opium, ℈iv. [ʒj. *D.*] Triturate them together thoroughly [and pass through a fine sieve, *D.*])—Astringent and narcotic. Employed in diarrhœa.—Dose for adults, ℈j. to ℈ij.: for children, grs. ij. to grs. x. according to their age. Forty grains of this powder, prepared according to the London or Dublin Pharmacopœia, or thirty-seven of the Edinburgh Pharmacopœia, contain one grain of opium.

8. CONFECTIO OPII, L.; *Electuarium Opii*, E.; *Confection of Opium; Philonium*[1] *Londinense; Philonium Romanum.* Opium, powdered, ʒvj.; Long Pepper, ℥j.; Ginger, ℥ij.; Caraway, ℥iij.; Tragacanth, powdered, ʒij.; Syrup, f℥xvj. The *London College* directs the dry ingredients to be kept mixed in the form of a very fine powder, and the syrup to be added when the confection is to be used. The *Edinburgh College* adopts the following formula:—"Aromatic Powder, ℥vj.; Senega, in fine powder, ℥iij.; Opium diffused in a little Sherry, ℥ss.; Syrup of Ginger, lb. j. Mix them together, and beat into an electuary."—Aromatic and narcotic. Employed in flatulent colic and diarrhœa; in the latter complaint usually as an adjunct to the chalk mixture.—Dose, gr. x. to ʒj.—The *Dublin* preparation of the older Pharmacopœias contained gr. j. of opium in about twenty-five grains of confection. The *London* preparation is somewhat weaker, and contains gr. j. of opium in perhaps thirty-six grains. The *Edinburgh* preparation is still weaker; forty-three grains of it containing about one grain of opium.

9. EMPLASTRUM OPII, L. E. D.; *Plaster of Opium.* (Extract of Opium,

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[1] The ancient philonium was a famous electuary of the opiate kind. It was called Philo's antidote, after Philo, of Tarsus, its inventor, who lived, it is supposed, in Augustus's time, The composition of the Philonium, described in Greek elegiac verse, is preserved and explained by Galen, *De med. comp. sec. loc.* lib. ix. 4. The terms of the recipe are enigmatical and may amuse some readers; we give the substance:—"Take of the yellow and fragrant hair of the divine Crocus, whose blood glitters in the fields of Mercury, as many drachms as a man has senses; of the Eubœan Nauplian, a drachm; of the slayer of Menœtiades, as preserved in the bowels of sheep, the like quantity; add twenty drachms of white flame, and twenty of the bean of the wild animal of Arcadia; a drachm of the root (falsely so called) which grows in the land famous for the Pisæan Jove; take twice five drachms of πιῶν, written with the masculine article prefixed; and mingle all with the production of the daughters of the bulls of Athens." Galen interprets this curious medico-poetical farrago, which, without his aid, would certainly be not a little obscure, as implying the admixture of saffron, pyrethrum, euphorbium, white pepper, hyoscyamus, spikenard, opium, and Athenian honey. It is, moreover, stated in the verses, that the pains for which this μέγα ἕυρεμα was most serviceable were those of colic, of the liver, dysuria, and stone.—(Dr. Wm. Cummin, *Lond. Med. Gaz.* vol. xvii. p. 990.)

℥j.; Prepared Resin of the Spruce Fir, ℥ij; Plaster of Lead, ℥viij.; Boiling Water, f℥j. Add the Resin of the Spruce Fir, the Opium and the Water, to the melted Plaster, and with a slow fire, boil down until all unite into a proper consistence, *L.*—The *Edinburgh College* omits the water. The formula of the *Dublin College* is as follows:—Of Opium, in very fine powder, ℥j.; Resin Plaster, ℥ix. Melt the plaster by steam or water bath, add the opium by degrees, and mix thoroughly. Employed as a tonic anodyne in rheumatism, lumbago, and neuralgia. Its powers are very slight, or even equivocal.

10. EXTRACTUM OPII, L.; *Extractum Opii,* E.; *Extractum Opii aquosum,* D.; *Extract of Opium.* (Opium sliced, lb. iss. [lb. j. *E. D.*]; Water [distilled, *L.* Ov.], [Ovj. *D.*] Add Oiiss. of the water to the opium, and macerate for twenty-four hours, stirring occasionally with a spatula, then strain. Macerate what is left in the remaining water for twenty-four hours, and strain. Lastly, evaporate to a proper consistence, *L.*—The *Edinburgh College* digests five times successively, each time in a pint of water, and for twenty-four hours each time. Filter the successive infusions as they are made, passing them through the same filter; unite and evaporate them in the vapour-bath to the due consistence.—The *Dublin College* digests the water in like manner, but in successive quarts.)—When opium is digested in water, this fluid takes up the *odorous principle,* the *salts of morphia and codeia,* the *narcotina,* the *gum,* the *extractive,* and some of the *resin.* A portion of morphia is frequently found in the dregs. Moreover, a portion of the *oil* is found in the solution. By concentration, the odorous principle is dissipated, and the resin and the oil, combined with and in part saturating the narcotina, are separated. These matters would be more completely got rid of by re-dissolving the extract in water. The removal of these inert principles, as well as the impurities of opium and the consequent concentration of the active constituents of this substance, must, of course, render the extract a more powerful preparation than ordinary opium. Good opium yields more than half its weight (from 60 to 70 per cent.) of extract, which, therefore, should be at least one-third more active than crude opium. It is usually believed to operate with less disturbance to the general system than the ordinary preparations of opium. It is employed as an anodyne, sedative, and soporific, in cases where crude opium or its tincture disagrees.—The dose of it is from gr. ¼ to gr. iij. or gr. iv.

LIQUOR OPII SEDATIVUS. (*Battley's Sedative Solution.*)—Mr. Battley, some years since, assured me that the only ingredients employed in the preparation of his *liquor opii sedativus* were opium, water, and heat. It appears to contain somewhat less meconic acid than the ordinary tincture of opium. Probably this and some other principles of opium are got rid of by successive evaporations and solutions. Perhaps an aqueous solution of the watery extract of opium, with the addition of a little spirit to preserve it, would be a convenient substitute.

[According to Mr. Wilkinson two fluidrachms of Battley's solution yield 5·4 grains of dry extract, and, assuming it to be an aqueous solution of opium, it appears that this is equivalent to 8·55 grains of powdered opium. Twenty minims of the solution would therefore contain 0·9 grains of the dry extract, and are equivalent to 1·42 grains of powdered opium, which is very nearly the strength of the Tinctura Opii of the London Pharmacopœia.[1]—ED.]

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[1] *Pharmaceutical Journal,* vol. xii. p. 253.

[LIQUOR OPII HYDROCHLORATIS. *Solution of muriate or hydrochlorate of Opium.*—Dr. Nicol has suggested the subjoined formula for this preparation. Take of best powdered opium, one ounce; hydrochloric acid, one ounce; distilled water, twenty ounces. Mix. Shake this mixture very frequently every day for fourteen days, then strain and filter. The dose is from twenty to forty drops. Dr. Nicol recommends this compound as possessing advantages over all the other preparations of that drug. It is the only one which, according to his experience, does not produce headache. He considers it even preferable to the salts of morphia.[1]—ED.]

11. TINCTURA OPII, L. E. D.; *Tincture of Opium; Laudanum.* (Opium, powdered, ℥iij.; Proof Spirit, Oij. Macerate for seven days, and filter, *L.*—The proportions used by the *Dublin College* are also ℥iij. of Opium and Oij. of proof spirit. The *Edinburgh College* directs,—"Opium sliced, ℥iij.; Rectified Spirit, Oj. and f℥vij.; Water, f℥xiiiss. Digest the opium in the water at a temperature near 212° for two hours; break down the opium with the hand; strain and express the infusion; macerate the residuum in the rectified spirit for about twenty hours, and then strain and express very strongly. Mix the watery and spirituous infusions, and filter.—This tincture is not easily obtained by the process of percolation; but when the opium is of fine quality, it may be prepared thus:—Slice the opium finely; mix the spirit and water; let the opium macerate in fourteen fluidounces of the mixture for twelve hours, and then break it down thoroughly with the hand; pour the whole pulpy mass and fluid into a percolator, and let the fluid part pass through, and the rest of the spirit without packing the opium in the cylinder, and continue the process of percolation till two pints are obtained," *E.*)—The percolation process of the Edinburgh College is unnecessary and troublesome, and will, I suspect, be rarely, if ever, adopted by laudanum preparers. Tincture of opium is of a deep brownish red colour, with the peculiar odour and taste of opium. Its sp. gr., according to Mr. Phillips,[2] is 0·952. Nineteen minims of it contain about one grain of opium. Proof spirit dissolves the same constituents as water, but it takes up a large proportion of narcotina, resin, and oil. I have repeatedly prepared morphia from the insoluble residue left behind in the preparation of the tincture.

[Some difference of opinion exists respecting the real strength of the Tincture of Opium of the Pharmacopœias. In the translation of the last edition of the *London Pharmacopœia*,[3] Mr. Phillips states that *nineteen minims* contain, or are equivalent to, one grain of solid opium, and he describes the ordinary dose as from ten to sixty minims. Mr. Squire, in his translation of the three Pharmacopœias, states that the tincture of opium is of the same strength in all, and that "one grain of powdered opium is employed to produce *thirteen minims* of the tincture." Dr. Christison says, "the Tinctura Opii, commonly called *laudanum*, is made by all the Colleges with such proportions of the opium and spirit, that about *thirteen minims and a half*, or about twenty-five drops, contain the active part of one grain of opium. But the London tincture may be sometimes sixteen per cent. stronger than the others, as dry opium is directed to be used. The tincture of the shops is very often adulterated.

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[1] See *Dublin Medical Press*, February, 1848.

[2] *Transl. of the Pharm.*

[3] *Pharm. Lond.* 1851.

Good tincture should leave, when thoroughly dried up in the vapour-bath, from seventeen to twenty-two grains of residuum for every fluid ounce; but I have several times found it so low as ten or seven only." The dose, according to Dr. Christison, is from fifteen to forty-five minims.

This question has been recently examined by Dr. Garrod, with results differing from those stated by the author. Dr. Garrod did not find that the undissolved portion, after maceration for the tincture, yielded any morphia. It yielded an abundance of narcotine and meconic acid. This residue, given internally, in doses varying from one to thirty grains, was found to be quite inert. Should traces of morphia be left after the ordinary processes of preparing the tincture of the London College, Dr. Garrod does not believe that this would make any appreciable difference in the strength of the preparation. He considers "that the *Tinctura Opii* contains the active matter of the *whole* of the drug used in its formation; and therefore about *twelve minims* of tincture of opium possess all the activity of *one grain* of crude opium, assuming that it loses only twelve per cent. in the drying. If dry opium is taken for comparison, *one grain* is contained in about *thirteen and a half minims;* and therefore one fluidrachm of tinctura opii contains five grains of the drug, or four and a half grains (according as it is compared with dry or moist opium), in place of three grains."

"In the Edinburgh preparation, the amount of tincture containing a grain of opium is about *thirteen and a half minims;* for the opium is ordered in the same proportion, but not previously reduced to powder or dried. In the Dublin preparation the opium is ordered to be coarsely powdered, but Avoirdupois weight is used in place of Apothecaries', which makes the strength of the tincture such that *twelve minims and three-quarters* contain one grain of opium."[1]

It follows from this statement, that when tincture of opium is properly made, and the directions of the London Pharmacopœia strictly carried out, the strength of the tincture is much greater than it has been supposed to be. *One fluidrachm* will represent a dose of *five grains*, instead of three grains of opium, as stated by the author and Mr. Phillips. The purity of the opium, its comparative strength in morphia, the strength of the spirit used as a solvent, and the period of maceration, will, however, materially affect the result. According to our observation, the statement of Dr. Christison, that the quantity of soluble matter taken up is subject to great variation, is correct; and unless it be assumed that the morphia is constantly in the same proportion in every sample of opium, and that the whole of the morphia is invariably taken up by the proof spirit, the tincture must necessarily vary in its strength. Mr. Wilkinson found that 1000 grains of Turkey Opium treated with successive portions of cold water until all the soluble matter was taken up, gave on evaporation a pulverisable dry extract weighing 550 grains. 1000 grains of the same sample lost 13 per cent. by drying; and when treated with proof spirit until exhausted, it gave a dry extract weighing 589 grains. Hence, it follows that the dry extract obtained from crude opium by cold water is 55 per cent., equivalent to 6·32 per cent. from powdered opium, and the quantity yielded to proof spirit by powdered opium is 67·7 per cent. Taking these as data for calculation, he finds that the Tinctura Opii, P. L. contains exactly 1·02 grains of dry extract in 20 minims, which, calculated on the same principle, is equivalent to 1½ grains of powdered opium. This is very nearly in the proportion of one grain in thirteen and a half minims of tincture.[1] A practical solution of this question would be obtained by observing whether the effects of a grain of opium are really obtained by the administration of twelve or thirteen minims of an average tincture.—Ed.]

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[1] See *Pharm. Journ.* for 1851, p. 250.

Tincture of opium is a powerful and valuable anodyne and soporific. Its employment is to be preferred to that of solid opium where a more immediate effect is required. Moreover, in administering opiates to children, the facility of adjusting small doses of it presents a great advantage over solid opium.—The dose of it, like that of solid opium, must vary according to several circumstances. For an adult it varies from ♏x. to fʒj. To children it must be given with the greatest caution. I have seen a powerful effect produced in an infant by one drop. In infants exhausted by illness and of a delicate constitution one minim might cause death. [This very small dose, equivalent to the 12th part of a grain of opium, or the 120th of a grain of morphia, has been known to prove fatal to an infant.[2]—Ed.]

[**12. TINCTURA OPII ACETATA,** U. S.; *Acetated Tincture of Opium.* Take of Opium, ℥ij.; Vinegar, ℥xij.; Alcohol, Oss. Rub the opium with the vinegar, then add the alcohol, and having macerated for fourteen days, express and filter through paper. This preparation is intended as a substitute for *Black Drop.* The dose is ♏x.—Ed.]

[**13. TINCTURA OPII CAMPHORATA,** E. D. U. S.; *Camphorated Tincture of Opium; Essentia Opii Benzoica, Pharm. Norveg.* This compound is well known under the name of Paregoric Elixir (Elixir Paregoricum, P. L. 1746). The formula for its preparation has been already described in Pt. 1, Vol. II., p. 460, under the name of *Tinctura Camphoræ Composita.* As its operation depends more on the opium than the camphor, the name assigned by the Edinburgh and Dublin Pharmacopœias appears more appropriate. It should in fact be regarded as a pharmaceutical preparation of opium, rather than of camphor.—Ed.]

14. ENEMA OPII, L.; *Enema Opii* vel *Anodynum,* E.; *Opium Clyster.* (Decoction of Starch, f℥iv.; Tincture of Opium, ♏xxx. Mix, *L.*—The *Edinburgh College* uses ʒss. of Starch; fʒss. to fʒj. of Tincture of Opium; and f℥ij. of Water. The starch is boiled in the water, and the tincture added when the mucilage is cool enough for use.)—The formula of the London College is, in my opinion, to be preferred to that of the Edinburgh College; but it may be sometimes necessary to double or treble the quantity of tincture employed. In the passage of renal calculi, in nephritis, irritation or inflammation of the bladder, uterus, or prostate gland, in dysentery, and painful affections of the large intestine, the opium clyster is most valuable.

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[1] *Pharmaceutical Journal,* vol. xii. p. 253.

[2] See case by Dr. E. Smith, *Med. Times and Gazette,* April 15, 1854, p. 386.

15 LINIMENTUM OPII, L. E.; *Linimentum Opii* vel *Linimentum Anodynum*, D.; *Liniment of Opium.* (Soap Liniment, f℥vj.; Tincture of Opium, f℥ij. [of each f℥j. *D.*] Mix, *L.*—Castile Soap, ℥vj.; Opium, ℥iss.; Camphor, ℥iij.; Oil of Rosemary, fʒvj.; Rectified Spirit, Oij. Macerate the soap and opium in the spirit for three days; filter, add the oil and camphor, and agitate briskly, *E.*)—Employed as an anodyne in rheumatism, neuralgic pains, sprains, &c.

[**16. UNGUENTUM OPII,** L.; *Ointment of Opium.* Take of Opium, powdered, a scruple; Lard, an ounce. Rub them together.]

17. VINUM OPII, L. E. D.; *Laudanum Liquidum Sydenhami*, Ph. L. 1720; *Tinctura Thebaica*, Ph. L.; 1745; *Wine of Opium.* (Opium, ℥iij. *E. D.* [Extract of Opium, ℥iiss. *L.*]; Cinnamon, bruised; Cloves, bruised, of each, ʒiiss.; Sherry Wine, Oij. Macerate for seven [fourteen, *D.*] days, and filter.)—The Dublin College omits the spices. Its effects are similar to those of the tincture of opium, but its taste and smell are more agreeable. It was recommended by Mr. Ware[1] as an application to the eye in ophthalmia; and experience has fully proved its efficacy where there is much scalding pain, lachrymation, and intolerance of light. When first applied it causes a sharp pain and a copious flow of tears, but these effects soon subside, and are followed by a considerable abatement of the former sufferings.—For internal use the dose is gtt. x. to fʒj.

18. TINCTURA OPII AMMONIATA, E.; *Ammoniated Tincture of Opium.* (Benzoic Acid, and Saffron, chopped, ʒvj. of each; Opium, sliced, ℥ss.; Oil of Anise, ʒj.; Spirit of Ammonia, Oij. Digest for seven days, and filter.)—Employed as a powerful diffusible stimulant and antispasmodic in hooping-cough and other spasmodic affections. Each drachm and a quarter contains about a grain of opium.—Dose, fʒss. to fʒj.

19. ACETUM OPII, E. D.; *Vinegar of Opium; Black Drop.* (Opium, ℥iv.; Distilled Vinegar, f℥xvj. "Cut the opium into small fragments, triturate it into a pulp with a little of the vinegar, add the rest of the vinegar, macerate in a closed vessel for seven days, and agitate occasionally. Then strain and express strongly, and filter the liquors," *E.*—The *Dublin College* uses one ounce and a half of Opium to one pint of Dilute Acetic Acid; macerates for seven days in a close vessel, with occasional agitation; strains, expresses, and filters.)—Vinegar dissolves all the principles of opium soluble in water, and is better adapted for holding in solution the narcotina and the resinous matter of opium. It cannot, of course, effect any change in the sulphate of morphia contained in opium. Whether any acetate of morphia is formed at the expense of the meconate of morphia has not been satisfactorily proved. The effects of vinegar of opium do not appear to be precisely those of ordinary opium. It is believed to possess the anodyne, sedative, and soporific qualities of opium, without being apt to excite the disagreeable effects (nausea, headache, constipation, and general disorder of the system) which sometimes result from the ordinary preparation of this drug. Hill[2] says that Le Mort observed a very odd effect from this preparation, "which was, that it often brought on suppressions of urine." Dr. Montgomery[1] has seen one instance of this effect; and Dr. Thomas Beattie[2] has remarked the same result from the *Black Drop*. This paralysing effect on the bladder is doubtless referable to the morphia, which seems to acquire, in this preparation, increased activity. Vinegar of opium is employed as an anodyne, sedative, and soporific. Dr. Montgomery observes, that he has found this preparation of opium decidedly superior to every other in relieving the agony of cancer uteri, and procuring rest at night." The same authority states, that twenty drops are equivalent to thirty of the common tincture of opium.—Dose, gtt. vj. to gtt. xxx.

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[1] *Remarks on Ophthalmy*, p. 29, 1780.
[2] *Hist. of the Mat. Med.* p. 784, 1751.

[The Pharmacopœia of the United States directs *Black Drop* (Acetum Opii, U.S.) to be prepared as follows:—Take Opium in coarse powder, ℥viij.; Nutmeg, in coarse powder, ℥iss.; Saffron, ℥ss.; Sugar, ℥xij.; Distilled Vinegar, a sufficient quantity. Digest the opium, nutmeg, and saffron with a pint and a half of distilled vinegar on a sand-bath, with a gentle heat for forty-eight hours, and strain. Digest the residue with an equal quantity of distilled vinegar in the same manner for twenty-four hours. Then put the whole into a percolator, and pass and repass until the liquid is clear. When filtration ceases, pour on the distilled vinegar to make three pints. Lastly add the sugar, and, by means of a water-bath, evaporate to three pints and four fluid-ounces.—Dose ♏x.—ED.]

BLACK DROP.—*Acetum Opii* may be regarded as the officinal substitute for a celebrated quack medicine called the *Black Drop*, or *The Lancaster*, or *Quaker's Black Drop*, the method of preparing which has been described by the late Dr. Armstrong. In this preparation *verjuice* (juice of the wild crab) is employed instead of vinegar. But there are several sources of uncertainty in the process.

Dr. Porter's *solution of opium in citric acid* has never come into general use.

20. UNGUENTUM GALLÆ COMPOSITUM. (See Vol. II. Pt. 1, p. 353.)

21. TINCTURA CAMPHORÆ COMPOSITA. (See Vol. II. Pt. 1, p. 460.)

22. PILULÆ STYRACIS COMPOSITÆ. (See Vol. II. Pt. 1, p. 682.)

23. PULVIS IPECACUANHÆ COMPOSITUS. (See *ante*, p. 65.)

24. PILULÆ IPECACUANHÆ ET OPII. (See *ante*, p. 66.)

25. PULVIS KINO COMPOSITUS. (See *ante*, page 327.)

26. ELECTUARIUM CATECHU. (See *ante*, p. 345.)

c. *Morphia and its Preparations.*

1. MORPHIA, D.; *Morphina, Morphine, Morphium.*—So called from *Morpheus*, the god of sleep.[1] Wedelius, Fr. Hoffman, and Neumann, speak of a *crystalline salt* obtained from a solution of opium; but they formed no correct notion of its nature. The *magistery of opium*, noticed by Ludwig, in 1688, may, perhaps, have been morphia.

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[1] *Observ. on the Dubl. Pharm.* p. 451, 1830.

[2] *Dubl. Hosp. Rep.* vol. v. p. 185.

[3] [Said to be derived from μορφη, *form*, from the images presenting themselves in dreams. —ED.]

Morphia is peculiar to the poppy tribe. It exists in opium in combination with meconic and sulphuric acids. Doubts, indeed, were formerly expressed with respect to its independent existence in opium, some chemists having suggested that it was a *product* rather than an *educt;* but it is now satisfactorily proved that there are no grounds for the supposition that it is a product.

[The *Dublin College* alone now admits morphia amongst its pharmaceutical preparations. The directions for preparing it are as follows:—

Take of Turkey Opium, cut into thin slices, lb. j.; Distilled Water, Ovj.; Chloride of Calcium, ʒvj.; Prepared Animal Charcoal as much as is sufficient. Macerate the opium for twenty-four hours with a quart of the water, and decant. Macerate the residuum for twelve hours with a second quart of the water, decant, and repeat this process with the rest of the water, subjecting the insoluble residuum to strong expression. Let the decanted solutions and expressed liquor be evaporated by a steam or water heat to the bulk of one pint, and then passed through a calico filter. Pour in now the chloride of calcium, first dissolved in four ounces of distilled water, and then proceed with the evaporation until the solution is so far concentrated, that upon cooling nearly the whole of it becomes solid. Let this solid matter be enveloped in a couple of folds of strong calico, and subjected to powerful pressure, the dark liquid which exudes being reserved for subsequent use. The squeezed cake is now to be acted upon with about half a pint of boiling water, and the whole being thrown upon a paper filter, the precipitate must be well washed. The filtered solution having been evaporated as before, cooled, and solidified, the residue is to be again subjected to expression. If the product be not quite white, this process should be repeated a third time, the liquid forced out during expression being always preserved. Let the squeezed cake be dissolved in six ounces of boiling water, and, if necessary, cleared by filtration through prepared animal charcoal, the portion of it soaked by the filter being carefully washed out of it; and to the solution thus obtained let water of ammonia be added, in slight excess, and let the crystalline precipitate which forms when the liquor has cooled be collected on a paper filter, and washed with cold distilled water until the washings cease to give a precipitate upon being dropped into an acid solution of nitrate of silver. Lastly, let the filter be transferred to a porous brick, in order that the morphia it contains may become dry.

The liquids separated by expression from the muriate of morphia in the preceding process, having been diluted with water, so as to occupy the bulk of four ounces, and then supersaturated slightly with ammonia, let the precipitate which forms be collected, after the lapse of six hours, on a filter, and washed with a little cold water. This, if redissolved in dilute muriatic acid, boiled with a little animal charcoal, and filtered, will, upon cooling, afford a crystalline deposit, from which, when pressed, dissolved in water, and supersaturated with ammonia, an additional quantity of morphia will be procured.—Ed.]

The following directions for preparing morphia were given in the former *London Pharmacopœia.* No directions are given in that for 1851.

Take of Hydrochlorate of Morphia, ℥j.; Solution of Ammonia, ʒv.; Distilled Water, Oj. Add the Hydrochlorate of Morphia, first dissolved in a pint of water, to the solution of Ammonia with an ounce of water, shaking them together. What is thrown down wash with distilled water, and dry it with a gentle heat.

In this process the ammonia unites with the hydrochloric acid, and the morphia being set free is precipitated.

Properties.—Pure morphia presents itself under the form of transparent crystals, whose primary form is the right rhombic prism. On turmeric paper, as well as on reddened litmus paper, morphia has an alkaline reaction. Notwithstanding that it is insoluble, or nearly so, in cold water, it has a distinctly bitter taste. Boiling water dissolves a little more than one-hundreth part of morphia. It dissolves in 40 parts of cold anhydrous alcohol, and 30 parts of boiling alcohol: but it is insoluble, or nearly so, in ether. It is soluble in the oils (fixed and volatile), in solutions of potash and soda, and also, but in much smaller quantity, in solution of ammonia; lastly, it readily dissolves in sulphuric, hydrochloric, and acetic acids. When heated, the crystals lose their transparency and water of crystallisation; a strong heat causes them to enter into fusion, in which state they form a yellow liquid similar to melted sulphur, and which becomes white and crystalline on cooling. Heated in the open air, it burns like resin, and leaves a carbonaceous residuum.

CHARACTERISTICS.—1st. *Nitric acid* reddens morphia or its salts (the chlorate excepted, according to Dumas) and forms with them an orange-red solution, which is much darkened by excess of ammonia, and which becomes yellow after a little time. By the prolonged digestion of morphia in nitric acid, we obtain oxalic acid.—*Fallacies.* Nitric acid produces a red colour with several other bodies, as brucia, commercial strychnia, several volatile oils (as oil of pimento and oil of cloves), some resinous substances, infusion of cloves or of pimento, &c.

2nd. *Iodic acid* is deoxidised by morphia, iodine being set free. Hence, when this alkali is added to a solution of iodic acid, the liquor becomes reddish brown, and forms a blue compound (*iodide of starch*) with starch. *Fallacies.*—Sulphuretted hydrogen, sulphurous acid, phosphorous acid, sulphocyanide of potassium, sulphosinapisin, [saliva, lithic acid, and the alkaline lithates,] and some other deoxidising agents, have a similar effect on iodic acid.

3dly. *Neutral sesquichloride of iron* dropped on crystals of morphia renders them blue. The same effect is produced on solutions of salts of morphia when concentrated. The nature of the blue compound is not perfectly understood. Possibly part of the morphia is oxidised, and the compound thus produced unites with some oxide of iron (*morphite of iron*). [This test acts best when added to a strong solution of a salt of morphia. Nitric acid, subsequently added, will destroy the blue and bring out the orange-red colour above described.—ED.] If water in excess, or acids, or alkalies, be added to the blue compound the colour is destroyed. *Fallacies.*—Tannic and gallic acids with a little water, and infusion of cloves or of pimento, also form blue compounds with sesquichloride of iron.

4thly. The *alkaline carbonates* occasion a white precipitate (*carbonate of morphia*) in solutions of the soluble morphitic salts.

5thly. *Solution of ammonia* precipitates morphia from its solution in acids. A considerable excess of ammonia redissolves the precipitate. In very dilute solutions, ammonia occasions no precipitate until heat be applied to drive off the excess of alkali.

6thly. *Infusion of nutgalls*, or a *solution of tannic acid*, causes a precipitate (*tannate of morphia*) in neutral solutions of the morphitic salts. The precipitate is soluble in acetic acid.

7thly. An alcoholic solution of *carbazotic acid* causes no precipitate in an alcoholic solution of morphia.

8thly. If a solution of *chlorine* be mixed with a solution of morphia, or its salts, and then ammonia added, a dark brown colour is developed.

[9thly. If to a mixture of morphia and concentrated sulphuric acid a drop of bichromate of potash be added, a brown colour results and ultimately green oxide of chrome is set free.—ED.]

10thly. A very sensitive test of the presence of morphia or its salts in solution is, to add a drop or two of chloride of gold: a yellow precipitate falls, which on shaking, is taken up; and if a drop of Liq. Potassæ be now added, it assumes various hues (according to the manipulation) first greenish, then bluish, then violet, and finally purple, owing to the reduction of the gold. The presence of morphia may be detected in a dilute coloured solution of opium, by simply dropping in the gold and potash without disturbing them; in the course of a few seconds, by placing a piece of white paper at the back of the vessel, purple clouds or streaks will be distinctly seen following the gold as it falls: the gold, in each instance, yields up its chlorine and is reduced; sometimes a blue black precipitate (oxide) is formed, varying according to the strength of the solution operated on. [Meconic acid produces similar effects.—ED.]

The *composition* of morphia is, according to Regnault,[1] as follows:—

	Atoms.	Eq. Wt.	Per Cent.
Carbon	35	210	71·91
Hydrogen	20	20	6·85
Nitrogen	1	14	4·80
Oxygen	6	48	16·44
Morphia	1	292	100·00

	Atoms.	Eq. Wt.	Per Cent.
Morphia	1	292	94·2
Water	2	18	5·8
Cryst. Morph.	1	310	100·00

Formula $C^{35}H^{20}NO^{6}$: Symbol $\overset{+}{M}$.

The *morphitic salts* are, for the most part, crystallisable. When pure, they are colourless. They have a bitter taste.

The following characters of the acetate and hydrochlorate of morphia are given in the *London Pharmacopœia* for 1851.

Acetate of Morphia (Sal ex Opio præparatus Crystalli).—Soluble in water and in rectified spirit, and, when the spirit is distilled from it, yields crystals, which are totally destroyed by heat. On the addition of Nitric acid, morphia becomes first red, and afterwards yellow. Tincture of sesquichloride of iron gives it a blue colour. Chlorine and [afterwards] ammonia being added to its salts, they are rendered of a brown colour, which is destroyed when more chlorine is added. Morphia is precipitated from its salts by solution of potash, which, added in excess, re-dissolves it.

[ADULTERATIONS.—Morphia is found contaminated with narcotina, codeia, and the colouring or resinoid matter of opium. Narcotina is best distinguished by the action of solution of caustic potash, which dissolves morphia but does not act on narcotina or codeia. Ether may be substituted, as this scarcely dissolves morphia, whereas it dissolves codeia and narcotina. The colouring or resinoid matter is detected by the colour of the morphia. If ammonia be added to a solution of hydrochlorate of morphia and codeia, the morphia is precipitated and the codeia left in solution. It is obvious that the process adopted by the Edinburgh College yields muriate of morphia contaminated with codeia.—ED.]

The precise relation which the effects of morphia and its salts bear to those of opium, is a point on which the profession is by no means agreed. Some recent writers[2] declare that, after having carefully compared the effects of the morphia salts with those of opium, they can discover no difference between them; but my own limited observation of the effects of these salts induces me to agree with those who admit the similarity, but not the identity, of the effects of these substances. Charvet[3] could observe no difference between them in their action on the *invertebrata*. But on the higher classes of the *vertebrata* there were obvious differences. The effects of morphia on *man* are in several respects different from those of opium, but they appear to want uniformity; that is, the same results have not been arrived at by different experimenters. This may in some cases at least be ascribed to the employment of morphia contaminated with some other principles of opium. *In small doses*, as from a quarter of a grain to one grain, acetate of morphia causes a feeling of distension or fulness about the head, some disturbance of vision, oftentimes headache, giddiness and somnolency, or actual sleep, which, however, differs from ordinary sleep, and is often more or less disturbed. The pupils are usually contracted. Orfila says this occurs in nineteen out of twenty cases. However, in some instances dilatation has been observed, and in others the pupil was natural. [One pupil has been found contracted and the other dilated.—ED.] The pulse is generally slow and small, though sometimes it is more frequent, and occasionally is soft and full. Itching of the skin is frequently noticed, or even a cutaneous eruption is by no means uncommon. Grain doses readily excite gastric uneasiness, nausea, and vomiting. One remarkable symptom often caused by acetate of morphia, especially in men, is a difficulty in voiding the urine, and which appears to depend on a weakened or paralytic condition of the bladder. Bally[1] lays great stress on this last-mentioned symptom, especially when a full dose of morphia has been taken. When these effects subside, loss of appetite, muscular feebleness, and constipation, are left behind. When the dose is increased, the effects become somewhat alarming. Great cerebral excitement is produced, vision is disordered and obscured, there is singing in the ears, and the patient, when lying horizontally, experiences sudden convulsive movements, like those produced by an electric shock. When a fatal dose has been swallowed, the stomach sometimes manifests irritation, but this is soon followed by great disorder of the cerebro-spinal system, which ultimately assumes an apoplectic character. The sight becomes dim, excessive weakness is experienced, gradually all consciousness is lost, and coma supervenes, attended usually with contracted, though sometimes with dilated pupils, coldness of the surface, frequent and small pulse, hurried stertorous respiration, and occasionally with convulsions. Before insensibility comes on, as well as when it is subsiding, there is itching of the skin. Difficulty in passing the water is also experienced, in consequence of the paralysed state of the bladder. Not unfrequently, lividity of skin is observed. In comparing the morphitic salts with opium, we observe that they are less stimulant, and less disposed to cause sweating, constipation, headache, and dryness of the tongue. The feelings which they excite are less agreeable, and hence they are not adapted to be substituted for opium by the eaters of this drug. They more readily affect the bladder than opium.

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[1] *Pharmaceutisches Central-Blatt für* 1838, S. 486.

[2] Trousseau and Pidoux, *Traité de Thérap.* i. 164, 1836.

[3] *De l'Action Comp. de l'Opium*, 1826.

The effects of morphia and its salts appear to be identical in their nature. The soluble salts (as the hydrochlorates) are more constant and certain in their operation than uncombined morphia, in consequence probably of the difficult solubility of the latter.

USES.—We employ morphia or its salts in preference to opium when our object is to make applications to the denuded dermis (*endermic medication.*) They are employed in this way *externally* for the purpose of alleviating violent neuralgic pains, and to relieve the excessive endermic operation of strychnia. Gastrodynia and obstinate vomiting are sometimes relieved by the endermic application of morphia to the epigastrium; and violent headache by the application of this remedy to the temples. Occasionally this mode of administration is adopted, when we wish to bring the general system under the calming and sedative influence of morphia, and where from some cause its exhibition by the mouth is objectionable. Some cases of maniacal delirium may be treated with advantage this way. The morphia salts are given *internally* in cases where we wish to obtain the anodyne, soothing, sedative, soporific, and antispasmodic qualities of opium, and where this drug is objectionable on account of its tendency to excite certain injurious effects already referred to. In all cases where both opium and the morphia salts are equally admissible, I prefer the former, its effects being better known and regulated: moreover, opium is to be preferred as a stimulant and sudorific, and for suppressing excessive mucous discharges.

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[1] *Mém. de l'Acad. Roy. de Méd.* i. 99.

ADMINISTRATION.—The salts are given internally, in substance or solution, in doses from one-eighth to one-fourth of a grain, or, beyond this. I have given in insanity two grains of muriate of morphia at a dose. For endermic use they are to be finely powdered, and applied to the extent of a grain or a grain and a half at a time.

2. **MORPHIÆ ACETAS**, L. E. D.; *Acetate of Morphia.*—This salt was formerly directed to be prepared by the *London College* as follows:—

Take of Morphia, ʒvj.; Acetic Acid, fʒiij.; Distilled Water, f℥iv. Mix the Acid with the water, and pour them upon the morphia to saturation. Let the liquor evaporate with a gentle heat, that crystals may be formed.

In this process the acetic acid saturates the morphia, and the solution by evaporation yields crystallised acetate of morphia.

The following are the directions of the *Edinburgh College:*—

"Take of muriate of morphia any convenient quantity. Dissolve it in fourteen times its weight of warm water, and, when the solution is cool, add aqua ammoniæ gradually, and with constant agitation, until there is a permanent but faint odour of ammonia in the fluid. Collect the precipitate on a calico filter, wash it moderately with cold water, and dissolve it by means of a slight excess of pyroligneous acid, in twelve parts of warm water for every part of muriate of morphia that was used. Concentrate the solution over the vapour-bath, and set aside to crystallise. Drain and squeeze the crystals, and dry them with a gentle heat. More acetate of morphia may be obtained on concentrating the mother liquor."

In this process the ammonia decomposes the muriate of morphia, and the precipitated morphia is afterwards dissolved in diluted pyroligneous (acetic) acid. In the Pharmacopœia of the *Dublin College* the following process is given.

"Take of Morphia, in fine powder, ℥j.; Rectified Spirit, ℥viij.; Acetic Acid of commerce (sp. gr. 10·44) fʒivss., or as much as is sufficient. Pour the spirit on the morphia, and, applying heat, gradually add the acetic acid until a neutral or a slightly acid solution is obtained. Let this be evaporated to the consistence of syrup by a steam or water heat, and then set by for a few days until it solidifies. In operations on the great scale it will be worth while to remove the spirit by distillation."

Acetate of morphia is usually prepared by evaporating its solution to dryness by a gentle heat. Obtained in this way it is amorphous. It is difficult to obtain it pure, as it readily undergoes decomposition, when its solution is evaporated, and is converted into a mixture of morphia, neutral acetate, and the super-acetate of morphia. Hence, as met with in commerce, it is imperfectly soluble in water, unless a few drops of acetic acid be added. It is usually slightly coloured. Its crystals, when pure, are colourless and radiating. The following is the composition of this salt:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Morphia	1	292	82·95
Acetic Acid	1	51	14·5
Water	1	9	2·55
Acetate of Morphia	1	352	100·00

Crystallised acetate of morphia is

Very readily dissolved by water. Its other properties are such as have been stated of morphia, *Ph. L.*

It is less soluble in alcohol than in water.

The *Edinburgh College* gives the following characters of the purity of this salt:—

One hundred measures of a solution of ten grains in half a fluidounce of water and five minims of acetic acid, heated to 212°, and decomposed by a faint excess of ammonia, yield by agitation a precipitate which, in twenty-four hours, occupies 15·5 measures of the liquid.

The dose of this and the other morphitic salts has been already mentioned.

[3. **LIQUOR MORPHIÆ ACETATIS**, L.; *Morphiæ Acetatis Liquor*, D.—Solution of Acetate of Morphia. Take of Acetate of Morphia, ʒiv.; Acetic Acid, ♏xv.; Distilled Water, Oj.; Proof Spirit, Oss. Mix and dissolve, *L.*—The dose of this solution is from ♏vj. to ♏xv.—Take of Acetate of Morphia, eighty-two grains; Rectified Spirit, five fluidounces; Distilled Water, fifteen ounces. Having added the spirit to the water, dissolve the acetate of morphia in the mixture; and if the solution is not quite clear, pass it through a paper filter.—D.]

4. **MORPHIÆ HYDROCHLORAS**, L.; *Morphiæ Murias*, E. D.; *Hydrochlorate* or *Muriate of Morphia.* In the last *London Pharmacopœia* this salt is placed in the Materia Medica as *Sal ex opio præparatus, Crystalli.* In a former edition it was directed to be prepared as follows:—

Take of Opium, sliced, lb. j.; Crystals of Chloride of Lead, ℥ij., or as much as may be sufficient; Purified Animal Charcoal, ℥iiss.; Hydrochloric Acid; Distilled Water; Solution of Ammonia, each as much as may be sufficient. Macerate the opium in four pints of distilled water for thirty hours, and bruise it; afterwards digest for twenty hours more, and press it. Macerate what remains again, and a third time, in water, that it may become free from taste, and as often bruise and press it. Evaporate the mixed liquors, at a heat of 140°, to the consistence of a syrup. Then add three pints of distilled water, and, when all the impurities have subsided, pour off the supernatant liquor. Gradually add to this two ounces of chloride of lead, or as much as may be sufficient; first dissolved in four pints of boiling distilled water, till nothing further is precipitated. Pour off the liquor, and wash what remains frequently with distilled water. Then evaporate the mixed liquors as before, with a gentle heat, that crystals may be formed. Press these in a cloth, then dissolve them in a pint of distilled water, and digest, with an ounce and a half of animal charcoal, in a heat of 120°, and strain. Finally, the charcoal being washed, evaporate the liquors cautiously, that pure crystals may be produced. To the liquor poured off from the crystals first separated, previously mixed with a pint of water, gradually drop in as much solution of ammonia, frequently shaking it, as may be sufficient to precipitate all the morphia. To this, washed with distilled water, add hydrochloric acid, that it may be saturated: afterwards digest it with two ounces of animal charcoal, and strain. Lastly, the animal charcoal being thoroughly washed, evaporate the liquors cautiously, that pure crystals may be produced.

Water extracts from opium the *meconate and sulphate of morphia and* *codeia;* a part of the *narcotina*, of the *meconine*, of the *narceine*, and of the *thebaina;* the brown acid *extractive;* and a part of the *resin*, and of the *fat oil*. When chloride of lead is added to infusion of opium, meconate with a little sulphate of lead, and some resinous colouring matter, are precipitated, while the hydrochlorates of morphia and of codeia are left in solution. A solution of the impure crystals is then decomposed by ammonia, by which the morphia is precipitated, while codeia and hydrochlorate of ammonia are left in solution. The morphia is dissolved in hydrochloric acid, and the solution of the hydrochlorate decolorised by charcoal.

The *Edinburgh College* adopts Gregory's process. Their directions for preparing this salt are as follows:—

"Take of Opium, ℥xx.; Water, Oviij.; Muriate of Lime, ℥j. or a slight excess.—Macerate the opium in fragments for twenty-four hours in two pints of water, and separate the infusion, squeezing well the residue. Repeat the maceration successively with two pints more of the water till the whole is made use of. Concentrate the whole infusion over the vapour-bath to one pint, and add the muriate of lime dissolved in four fluidounces of water. Set the whole aside to settle; pour off the liquid; wash the sediment with a little water, adding the washings to the liquid. Evaporate the liquid sufficiently in the vapour-bath for it to solidify on cooling. Subject the cooled mass to a very strong pressure in a cloth; redissolve the cake in a sufficiency of warm distilled water; add a little powder of white marble, and filter; acidulate the filtered liquor with a very little muriatic acid; and concentrate a second time in the vapour-bath for crystallisation. Subject the crystals again to a very strong pressure in a cloth. Repeat the process of solution, clarification by marble and muriatic acid, concentration and crystallisation, until a snow-white mass be obtained.

"On the small scale, trouble and loss are saved by decolorising the solution of muriate of morphia by means of a little purified animal charcoal after two crystallisations. But on the large scale it is better to purify the salt by repeated crystallisations alone, and to treat all the expressed fluids, except the first, in the same way with the original solution of impure muriate of morphia. An additional quantity of salt may often be got from the first dark and resinous fluid obtained by expression, on merely allowing it to remain at rest for a few months, when a little muriate of morphia may be deposited in an impure condition. The opium which yields the largest quantity of precipitate by carbonate of soda, according to the formulæ in p. 617, yields muriate of morphia not only in greatest proportions, but likewise with the fewest crystallisations."

In this process the changes are analogous to those before described for the process of the London Pharmacopœia, except that meconate and sulphate of lime, instead of meconate and sulphate of lead, are produced.

The *Dublin College* gives the following directions:—

"Take of Morphia, in fine powder, ℥j.; Pure Muriatic Acid, fʒivss., or a sufficient quantity; Distilled Water, ℥iiss. Mix the acid with the water: heat to about 200°, and add the morphia, constantly stirring, so that a solution may be formed having a slightly acid reaction. Set this to cool for twelve hours, and let the crystals that separate, be drained of the liquor which surrounds them, and dried on blotting paper. The decanted liquor will, by further concentration and cooling, give additional crystals."

Another, and, as it is believed, a greatly improved method of obtaining morphia, has been recently suggested by Mohr.[1] It consists in adding, to a concentrated infusion of opium, milk of lime prepared with a quantity of dry lime, equal to the fourth part of the weight of the opium. The mixture is heated till it boils, and is filtered while hot through linen. The filtered liquor has a light brown yellow colour. While still hot it is mixed with pulverised sal ammoniac in excess; the lime is saturated by the muriatic acid of the sal ammoniac, and the ammonia of the latter is set free, and the morphia precipitated. In this way crystallised morphia may be obtained without the use of alcohol.

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[1] *Athenæum* for 1840, p. 772; *Report of the Tenth Meeting of the British Association*, Lond. 1841; and *Berlinisches Jahrbuch*, Bd. xliii. S. 448.

Pure hydrochlorate of morphia crystallises in plumose, acicular crystals. It is colourless, odourless, bitter, soluble in from 16 to 20 parts of cold water, but in less of boiling water. When its saturated boiling solution is allowed to cool, it congeals to form a crystalline mass. It is soluble in alcohol. By heat it is decomposed and totally dissipated. Nitric acid reddens it. Sesquichloride of iron with an alkali colours it blue.

The air-dried crystals are thus composed:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Morphia	1	292	76·24
Hydrochloric acid	1	37	9·66
Water	6	54	14·10
Crystallised Hydrochlorate of Morphia	1	383	100·00

According to the *London College*, crystallised hydrochlorate of morphia should be—

> Soluble in rectified spirit and in water. What is precipitated from the aqueous solution by nitrate of silver is not entirely dissolved either by ammonia, unless added in excess, or by hydrochloric or nitric acid. It agrees in other respects with what is stated above of the acetate of morphia.

The *Edinburgh College* gives the following characters of its purity;—

> "Snow white; entirely soluble; solution colourless; loss of weight at 212° not above 13 per cent.; one hundred measures of a solution of 10 grains in half a fluid-ounce of water heated to near 212°, and decomposed with agitation by a faint excess of ammonia, yield a precipitate which, in twenty-four hours, occupies 12·5 measures of the liquid."

On the above I would merely observe, that Mr. Sandall[1] found that the quantity of water which this salt lost by drying varied from 9·20 to 14·33 per cent. The effects, uses, and doses of this, as well as the other morphitic salts, have been already described.

5. **LIQUOR MORPHIÆ HYDROCHLORATIS**, L.; *Morphiæ Muriatis Solutio*, E.; *Morphiæ Muriatis Liquor*, D.; *Solution of Muriate of Morphia.* (Take of Hydrochlorate of Morphia, ʒiv.; Distilled Water, Oj.; Proof Spirit, Oss.. Mix and dissolve, *L.*—Muriate of Morphia, ʒiss.; Rectified Spirit, f℥v.; Distilled Water, f℥xv. Mix the spirit and water, and dissolve the muriate of morphia in the mixture with the aid of a gentle heat, *E. D.*)—About one hundred and six minims of this solution contain one grain of muriate of morphia.—The dose is from ♏x. gradually increased to fʒss.

6. **TROCHISCI MORPHIÆ**, E.; *Morphia Lozenges.* (Muriate of Morphia, ℈j.; Tincture of Tolu, ℥ss.; Pure Sugar, ℥xxv. Dissolve the muriate of morphia in a little hot water; mix it and the tincture of tolu with the sugar; and, with a sufficiency of mucilage, form a proper mass for making lozenges; each of which should weigh about fifteen grains.) —Each lozenge contains about one-fortieth of a grain of muriate of

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[1] *Lond. Med. Gaz.* xxii. 186.

morphia. The morphia lozenges of the shops usually contain each one-twenty-fourth of a grain of muriate of morphia. This is an agreeable mode of employing morphia, especially in pectoral affections.

7. TROCHISCI MORPHIÆ ET IPECACUANHÆ, E.; *Morphia and Ipecacuanha Lozenges.* (Muriate of Morphia, ℈j.; Ipecacuan, in fine powder, ʒj.; Tincture of Tolu, f℥ss.; Pure Sugar, ℥xxv. Dissolve the muriate in a little hot water; mix it with the tincture and the ipecacuan and sugar; and, with a sufficiency of mucilage, beat the whole into a proper mass, which is to be divided into fifteen-grain lozenges.)—Each lozenge contains about one-fortieth of a grain of muriate of morphia, and one-thirteenth of a grain of ipecacuanha. Useful to allay tickling cough.

8. MORPHIÆ SULPHAS; *Sulphate of Morphia.*—This salt, though not contained in the British Pharmacopœias, is occasionally used in medicine. It is crystalline, and readily soluble in water. It consists of 1 atom *sulphuric acid* = 40, 1 atom *morphia* — 292, and 6 atoms *water* = 54. One of these atoms of water is an essential constituent of the salt, and cannot be removed without destroying the salt. The other 5 atoms are the water of crystallisation. The dose of it is the same as the other morphitic salts.

[**9. LIQUOR MORPHIÆ SULPHATIS**, U. S.; *Solution of Sulphate of Morphia.* (Take of crystallised Sulphate of Morphia, gr. j.; Water, ℥j. Dissolve.—Dose, ʒj. to ʒij.)—Ed.]

[347. SANGUINARIA CANADENSIS, *Linn.*—BLOODROOT.

Sex. Syst. Polyandria Monogynia.

(Sanguinaria, *U. S.* The Root.)

Gen. Char.—*Calyx* pentaphyllous, deciduous. *Petals* eight. *Stigma* sessile, two-grooved. *Capsule* superior, oblong, one-celled, two valved, apex attenuated. *Receptacles* two, filiform, marginal (*Nuttall*).

Sp. Char.—*Root* tuberous, horizontal, giving out a reddish and a very acrid lactescent sap. *Leaves* solitary, radical, reniform and lobed. *Scape* naked, one-flowered, sheathed at base. *Petals* variable in number. April. Perennial.

This plant is called *Bloodroot*, from the red colour of its root, which, when wounded, pours out a quantity of red viscid juice. The same issues from the stalks of the leaves and flowers, but to a less amount. It is also known by the name of *Puccoon.* It grows throughout the United States, appearing in open woods at an early period of the spring, which it highly ornaments by its handsome white flowers.

The root is horizontal, from an inch to two inches in length, and half an inch in diameter, thicker at the summit, terminating abruptly as if bitten off (*præmorse*), fleshy, succulent, and beset with slender red fibres or radicles. It is taken from the ground during the summer, and when dried becomes dark brown externally, contracted, wrinkled, somewhat twisted. It breaks with a short, waxy fracture, presenting an orange-red colour upon the fractured surfaces. Its odour is feebly narcotic, disagreeable, but lost in a measure by drying. Its taste is acrid and bitter. The powder is greyish-red.

Sanguinarina.—This alkaloid was obtained by Dr. Dana by digesting the finely-powdered root in absolute alcohol, and adding to the solution ammonia, so long as a precipitate is thrown down. This is boiled in water with animal charcoal, and filtered; what remains on the filter is digested in alcohol and dried by evaporation. A *white pearly substance* is obtained. It has an acrid taste, renders the yellow of turmeric brown, and changes the infusion of purple cabbage to a green colour. It is sparingly soluble in water, but soluble in ether and alcohol. With tincture of galls it affords a precipitate soluble in alcohol, but insoluble in ammonia. It combines with acids, forming salts, which present some shade of red, crimson, or scarlet of great intensity of beauty.[1]

MEDICINAL PROPERTIES.—The root is narcotic, emetic, and purgative in large doses: stimulant, diaphoretic, expectorant in small doses. Dr. Donney, of Maryland, found that twenty grains of the root induced nausea and vomiting. The seeds produced torpor, languor, disordered vision, and dilatation of pupil. It may be regarded as an acrid narcotic. It has been much used in the United States.

DOSE.—As an emetic, x. to xx. grs. of the powdered root; as a stimulating expectorant, gr. iij. to v. Infusion of ℥ss. of the root to Oj. water, dose a tablespoonful: of the tincture, ʒss.[2]—ED.]

OTHER MEDICINAL PAPAVERACEÆ.

The *Argemone Mexicana*, or Prickly Poppy, grows in the district of Charleston, U.S Its seeds are narcotic, and are smoked with tobacco.

ORDER LXXXV. MENISPERMACEÆ, *De Candolle.*—THE COCCULUS TRIBE.

MENISPERMEÆ, *Jussieu.*

CHARACTERS.—*Flowers* (by abortion?) unisexual, usually diœcious, very small. *Floral integuments* in one or several rows, each of which consists of three or four parts, hypogynous, deciduous. *Petals* sometimes absent. *Males: stamens* monadelphous, or rarely distinct; sometimes equal in number and opposite to, the petals; at other times three or four times as many: *anthers* adnate, turned outwards, or inserted on the apex of the filament. *Females: ovaries* sometimes numerous, each with one style cohering slightly at the base; sometimes solitary, crowned with many stigmas, internally many-celled, and, therefore, consisting of many carpels soldered together. *Drupes* usually berried, 1-seeded, oblique or lunate, compressed. *Seed* of the same shape as the fruit; *embryo* curved or turned in the direction of the circumference; *albumen* 0, or small and fleshy; *cotyledons* flat, sometimes lying face to face, sometimes distant from each other, and lying in two cells of the seed!; *radicle* superior, but sometimes appears inferior, when the apex of the fruit is, by the mode of growth, contiguous with the base.—Sarmentaceous flexible tough *shrubs*. *Leaves* alternate, simple or rarely compound, mucronate. *Flowers* small, usually racemose (De Cand.)

PROPERTIES.—The roots of several species are bitter and tonic; the seeds of some of them are narcotic.

348. COCCULUS PALMATUS, *De Candolle, L. E.*—THE CALUMBA PLANT.

Menispermum palmatum, *Lamarck.*
Sex. Syst. Diœcia Hexandria.
(Radix, *L.*—Root, *E. D.*)

HISTORY.—Franciscus Redi,[3] in 1675, is the first writer who mentions the root of this plant: he praises it as an alexipharmic or antidote for poisons.

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[1] [Smith, in *Journ. of Philadelphia Col. of Pharm.* vol. iii. p. 95.]

[2] [For a further account of the medicinal uses of this plant, see *Trans. Amer. Med. Assoc.* 1849 vol. xi. p. 690.—ED.]

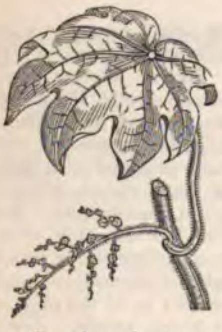
[3] *Exp. circa varias res nat.* p. 179.

Cartheuser afterwards examined it; but Dr. Thomas Percival[1] gave the best account of it. This root has been known by various names,—such as *Calumba, Colombo, Calomba,* and *Colomba.* Its native country and history were long involved in obscurity. In 1830, Dr. Hooker[2] published a complete description of both male and female plants. The root was at first supposed to come from Colombo, a town of Ceylon, and from which it was said to derive its name. But it is now known to be the produce of Mozambique. Its English name, Calumba, is derived from the Portuguese word *Kalumbo,* the *o* in which is mute.[3]

BOTANY. **Gen. Char.**—*Flowers* unisexual, (always ?) diœcious. *Calyx* of 12 sepals in four series, with 2, 3, or more, close-pressed bracteoles. *Males: stamens* 6, or rarely 3, opposite to the inner sepals, distinct; *anthers* 2-celled, terminal, dehiscing vertically; *filaments* either filiform with the anther cells horizontal, approximate, and each externally 2-lobed, or thickened at the apex with the cells divaricating downwards, and separated by the connective. *Females: ovaries* 3, 6, or numerous. *Drupes* 1 to 6, or numerous, 1-celled, 1-seeded. *Peduncles* axillary or rarely lateral; males usually many-flowered; females usually few-flowered, without bracts, or with very small ones if present (Lindley).

Sp. Char.—*Leaves* cordate at the base, 5- to 7-lobed; lobes quite entire, acuminate, somewhat hairy. *Stems* and *ovaries* clothed with glandular hair (De Cand.)

FIG. 106.



Cocculus palmatus.
(Male plant.)

Root perennial, of several fasciculated, fusiform, fleshy tubers, with a brown warty epidermis; internally deep-yellow, odourless, very bitter. *Stems* annual, herbaceous, twining, beset at the lower part with long glanduliferous hairs: of the males, simple; of the females, branching. *Leaves* alternate, nearly orbicular, wavy on the margin, with long hairy foot-stalks. *Racemes* axillary, solitary; in the male plants compound. *Flowers* small, green. *Fruit* drupaceous or berried, about the size of a hazel nut, densely clothed with long spreading hairs, tipped with a black oblong gland.[4]

Hab.—Thick forests on the shores of Oibo and Mozambique, as well as inland for 15 or 20 miles.

PREPARATION OF THE ROOTS.—The natives never cultivate the plant, the spontaneous produce being sufficient. The roots are dug up in March (the hot season), the offsets from the main root are cut in slices, strung on cords, and hung up to dry in the shade. It is deemed fit for commerce when, on exposure to the sun, it breaks short; and of a bad quality when it is soft or black.

DESCRIPTION.—Calumba or Colombo root (*radix calumbæ*) is met with in flat circular or oval pieces, of from half an inch to three inches diameter, and from one to three or four lines thick. It occurs also in cylindrical pieces of from one to two inches long. The epidermis covering the sides of the pieces is of a yellowish grey or brownish colour, smooth, or irregularly rugous. The transversal surfaces are of a greenish or greyish yellow colour, depressed in the middle from the great shrinking of the medulla in the drying process, and consist of three or four concentric layers. The outer or cortical portion varies in thickness, but is usually about two or three lines thick. It is separated from the ligneous portion by a dark-coloured layer, not exceeding a hair in thickness. The internal or medullary portion is light, spongy, and shrunk. The odour of calumba is faint, but somewhat aromatic: the taste aromatic, and very bitter. In the larger and thicker pieces small holes are occasionally observed, which have been made for the convenience of drying. On account of the starch which it contains, the root is readily attacked by insects.

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[1] *Med. Essays,* vol. ii. p. 3, 1773.

[2] *Bot. Mag.* 2970-71.

[3] Berry, *Asiatic Researches,* x. 385.

[4] Bojer, in Hooker's *Bot. Mag.* tt. 2970-71.

I am indebted to Mr. N. B. Ward for a sample of calumba root cultivated at the Mauritius. It is deficient in the bright greenish yellow tint of the Mozambique calumba.

COMMERCE.—In the year 1838, duty (2d. per lb.) was paid on 19,805 lbs., and in 1839 only on 9384 lbs. of calumba.

COMPOSITION.—The more recent analyses of calumba root are those of Planche[1] and Buchner.[2]

	Planche.	*Buchner.*
Bitter matter	13	10 to 12·2
Animal matter, soluble in water and not in alcohol	6	0
Yellow resinous extractive	0	5·0
Volatile oil	a trace.	0·0
Wax	0	0·2
Gum	9	3·8 to 4·7
Starch	33	30 to 35
Vegetable medulla [pectin ?]	0	17·4
Woody fibre	39	12·6
Water	0	9·8
Loss	...	?
Calumba Root	100	100

1. ODOROUS PRINCIPLE (*Volatile Oil?*).—The odour of the root is supposed to depend on a volatile oil, traces of which were procured by Planche. The distilled water of the root possesses the odour of the latter.

2. CALUMBIN (*Bitter Principle*).—A crystallisable, odourless, very bitter, neutral substance, extracted from Calumba root by Wittstock.[3] Its crystals are rhombic prisms. It is fusible; very slightly soluble in water, alcohol, ether, and volatile oils. Boiling rectified spirit dissolves about 1-40th of its weight. It dissolves in acids and alkalies; its best solvent being acetic acid. It is unaffected by metallic solutions, and by infusion of nutgalls. Sulphuric acid dissolves it, assuming first a yellow, then a red colour. Its composition, according to Liebig, is *carbon* 65·45, *hydrogen* 6·18, *oxygen* 28·37 : or $C^{12}H^{7}O^{4}$.

Planche describes the active principle of calumba as a *yellow bitter matter* soluble in water and alcohol, and yielding no precipitate either with the salts of lead or infusion of galls.

3. STARCH.—This constitutes about one-third by weight of the root. It renders the root an easy prey to insects. The structure of the starch particles has been described by Payen.[4] These bodies are remarkable by their gibbosities, and by the hilum being found on the largest part of the particles.

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[1] *Bull. de Pharm.* iii. 189.

[2] *Pharm. Centr.-Blatt für* 1831, S. 429.

[3] *Ibid.* 1830, S. 517.

[4] *Ann. Scient. Nat., Botany,* July 1838, p. 20.

[4. BERBERINA ($C_{42}H_{20}NO_{11}$).—This alkaloidal base, which was discovered by Buchner and Herberger in the common barberry (*Berberis vulgaris*), has been found in calumba root with calumbin (combined with calumbic acid) by Bödecker, and, more recently, by Mr. Perrins, in columba wood from Ceylon derived from the *Menispermum fenestratum*, and by Dr. Stenhouse, in the yellow bark of the *Cœlocline Polycarpa.*[1] Mr. Perrins extracted it in rather large quantity by acting on an aqueous decoction of the wood with alcohol. The crystals obtained were purified by animal charcoal. The reactions were those of berberina; but the formula assigned to them by this gentleman ($C_{42}H_{18}NO_{9}$) differs from that of Fleitmann, above given. The alkaloid pervades the whole of the wood, and acts as a colouring principle to it. It may be obtained from this source in comparatively large quantity.

Properties.—The crystals are fine stellated prisms of a yellowish colour, containing twelve atoms of water. Berberina is without smell, has a strong bitter taste, and manifests no reaction on test-paper. When heated to 212° it acquires a red colour, but becomes again yellow on cooling. At a much higher temperature it is decomposed, and gives off yellow vapours. It is very soluble in alcohol, but is precipitated from its alcoholic solution by water. The alcoholic solution is green by reflected light. At 60° it is soluble in 500 parts of water, forming a clear yellow solution. It is destroyed by concentrated sulphuric or nitric acid. It forms saline combinations, more or less soluble, with the mineral acids.

Medicinal Uses.—Berberina is considered to possess a purgative action. A decoction of calumba containing but little calumbin, owing to the insolubility of this principle, holds berberina dissolved. It may be a proper subject of inquiry whether berberina and its salts should not be employed medicinally in place of the preparations derived from calumba root.[2] According to M. Altin, when, after attacks of cholera, a mucous colourless diarrhœa continues, and the urinary secretion is not re-established, berberina is an effectual remedy for these conditions. It exerts remarkable effects in the different cases of gastricismus, accompanied by disturbed action of the liver, which may be rendered severe and obstinate under an epidemic influence. It is also very useful in ordinary dyspepsia and cardialgia. The combination with lactate of iron is excellent: cases of chlorosis have yielded to it when iron alone has failed.[3]—ED.]

CHEMICAL CHARACTERISTICS.—If the root be moistened with water, and then touched with tincture of iodine, it becomes black. A decoction of the root, when cold, forms with a solution of iodine a blue colour (*iodide of starch*). Sulphate of iron, emetic tartar, and gelatine, produce no obvious change in an infusion of calumba, showing the absence of tannic, and gallic acids. Litmus detects no free acid. Infusion of nutgalls causes in the infusion of calumba a precipitate (*tannate of starch?*)

ADULTERATION.—The root of *Frasera Walteri*, called the *American* or *false calumba*, has been occasionally substituted for calumba root on the continent. Such a fraud would not be practicable in England, at least to any extent, as the appearance of the root is quite dissimilar from that of the genuine calumba. It is distinguished chemically from the latter by three characters: 1st, it undergoes no change of colour when touched with tincture of iodine, showing that it contains no starch; 2ndly, it becomes blackish green on the addition of persulphate of iron; 3rdly, it yields a precipitate with a solution of gelatine. The two last characters indicate the presence of tannic acid.[4]

PHYSIOLOGICAL EFFECTS.—Calumba is an excellent tonic, promoting the appetite, assisting the digestive process, and improving the quality of the secretions from the gastro-intestinal mucous membrane. It is not a stimulant; for Dr. T. Percival took a scruple of it on an empty stomach, but did not observe that it had the least effect on the regularity, fulness, or velocity of the pulse. In another experiment he swallowed half a drachm: in ten minutes his pulse was fuller, and slower by three beats, and continued so for three-quarters of an hour. In consequence of the quantity of starch and gum which it contains, it is sometimes termed a *mucilaginous* or *demulcent tonic*. *Cetraria islandica* and Simaruba bark agree with calumba in this circumstance. But from them, as well as from quassia, it is distinguished by its aromatic properties. In some respects (*i. e.* in its tonic and aromatic qualities) it approximates to rhubarb, but it is devoid of the purgative and astringent properties of the latter. Its want of astringency distinguishes it from the astringent tonics (as cinchona). Full doses of it, in the form of powder, given when the stomach is very irritable, cause vomiting. It does not appear either to constipate or relax the bowels. We are not acquainted with the effects of excessive doses of it. Poisonous properties have been assigned to it by Buchner,[1] who states that Härtl, one of his pupils, applied a grain of the ethereal extract of calumba, deprived of wax by repeated solution in water, to a wound in the leg of a rabbit, and that it proved fatal in ten hours.

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[1] [*Pharm. Journ.* Feb. 1857, p. 400; also vol. xii. p. 188.

[2] See Schwarzkopf, *Chemie der Organischen Alkalien*, p. 404, 1855.

[3] Schmidt's *Jahrbuch*, xci. p. 49; and *Medical Times and Gazette*, 1856.

[4] The ordinary infusion of the shops is generally darkened by a persalt of iron.—ED.]

USES.— Calumba is one of our most useful stomachics and tonics. Its great value consists in its not being apt, like other and more powerful tonics, to create nausea, sickness, febrile disorder, or headache, so that it is tolerated when other remedies of this class would be immediately rejected. Indeed on many occasions it evinces a positive power of checking vomiting. Schwilgué,[2] in order to test its anti-emetic qualities, gave it when vomiting had commenced after the use of emetic tartar and ipecacuanha. It frequently arrested the vomiting. He also gave it in conjunction with these emetics, and observed that the vomiting occurred more slowly than usual, and was milder. Probably it owes these valuable properties to a combination of circumstances; such as its freedom from acidity and astringency, the large quantity of starch which it contains (from which it acquires demulcent properties), and the peculiar operation of its bitter principle. The following are the principal uses to which it has been applied:—

1. *In a languid state of the stomach, with general debility,* attended with want of appetite, indigestion, nausea, and flatulence, experience has fully established the value of calumba, and has proved the justice of the encomiums passed on it by Dr. T. Percival. It is of all tonics the least likely to disagree with the stomach. In the stage of convalescence after an attack of fever, the infusion of calumba is an excellent preparative for the more powerful tonics (infusion of cinchona and disulphate of quina). In those forms of dyspepsia attended with great acidity of stomach, it may be given with advantage in combination with bicarbonate of potash.

2. *To allay vomiting,* when not dependent on inflammatory conditions of the stomach, calumba is often highly serviceable; as in bilious vomiting, in the sickness which so frequently attends pregnancy, and dentition. Even vomiting arising from renal calculi or diseased kidney has been

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[1] *Toxikol.* S. 229.

[2] *Mat. Méd.* ii. 374.

somewhat palliated by calumba. I have seen the most satisfactory results from the combined use of the infusion of calumba and effervescing draughts (composed of citric acid and bicarbonate of potash) in those occasional attacks of vomiting especially observed in delicate females, and which are commonly termed bilious attacks. By this treatment the violence and continuance of the vomitings have been diminished, and the continued employment of calumba has reduced the frequency, and in some cases prevented the occurrence, of future attacks.

3. *In diarrhœa and dysentery*, where tonics are admissible, as in the later periods of these diseases, when the inflammatory symptoms have subsided, and in habitual diarrhœa, calumba often proves serviceable. In Germany it is denominated *Ruhrwurzel* (i. e. *dysenteric root*).

ADMINISTRATION.—Calumba is administered in the form of *powder*, *infusion*, or *tincture*. The dose of the *powder* is from gr. x. to ʒss. The infusion is the most eligible form of exhibition.

1. **INFUSUM CALUMBÆ**, L. E.; *Infusum Colombæ*, D.; *Infusion of Calumba*. (Calumba, sliced [in coarse powder, *E. D.*], ʒv. [℥ss. *E.* ʒiij. *D.*]; Boiling [distilled, *L.*] Water [Cold Water, *E. D.*], Oj. [℥ix. *D.*] Macerate for two hours in a lightly covered vessel, and strain, *L. D.*—"Triturate the calumba with a little of the water, so as to moisten it thoroughly, put it into a percolator, and transmit cold water till f℥xvj. of infusion be obtained," *E.*)—The facility with which this preparation undergoes decomposition is ascribed by Planche to the substance which he terms *animal matter*.—Dose of the infusion, f℥j. to f℥ij. It may be conjoined with alkalies or chalybeates, without injury or obvious change. [Infusion of calumba becomes turbid by allowing it to stand on the dregs.—ED.]

2. **TINCTURA CALUMBÆ**, L. E.; *Tinctura Colombæ*, D.; *Tincture of Calumba*. (Calumba, sliced [in small fragments; if by percolation in moderately fine powder, *E.*], ℥iij. [℥v. *D.*]; Proof Spirit, Oij. Macerate for seven days [fourteen, *D.*], and filter.—"Express the residuum strongly, and filter the liquors. This tincture is much more conveniently prepared by the process of percolation, allowing the powder to be soaked with a little of the spirit for six hours before putting it into the percolator," *E.*)—An excellent adjunct to bitter infusion and effervescent medicines, when given to check vomiting.—Dose, fʒj. to fʒij.

349. ANAMIRTA COCCULUS, *Wight and Arnott, E.*—THE COCCULUS INDICUS PLANT.

Sex. Syst. Diœcia Monadelphia.

(Fruit, *E.*)

HISTORY.—"According to Sprengel,[1] the fruit now usually called *Cocculus indicus* was introduced by the Arabians, and was described by Avicenna and Serapion under the name of *Maheradsch*."[2] In my copy, however, of the Latin translation of Avicenna,[1] the word *Maheradsch* does not occur: but *Mahezeheregi* or *Maheizhera*[2] is said to intoxicate fish. Nor can I find it in Serapion. Cocculus indicus is sometimes termed the *Levant nut*, or *bacca orientalis*.

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[1] *Berl. Jahrb.* xxiii. 1822, S. 70.

[2] Schwartze, *Pharm. Tabell.* S. 388, 2te Ausg.

BOTANY. **Gen. Char.**—*Flowers* diœcious. *Calyx* of 6 sepals in a double series, with 2 close-pressed bracteoles. *Corolla* 0. *Male: stamens* united into a central column dilated at the apex; *anthers* numerous, covering the whole globose apex of the column. *Female: flowers* unknown. *Drupes* 1 to 3, 1-celled, 1-seeded. *Seed* globose, deeply excavated at the hilum; *albumen* fleshy; *cotyledons* very thin, diverging.—Twining *plants*, with a corky bark. *Leaves* more or less cordate-ovate. *Flowers* in lateral compound racemes (Wight and Arnott).

Sp. Char.—The only species.

A strong climbing *shrub*. *Bark* deeply cracked, ash-coloured. *Leaves* stalked, large (from 8 to 12 inches long); petiole a little shorter than the leaves.

Hab.—Malabar, and Eastern Islands, &c. of India.

DESCRIPTION.—As met with in commerce, *Cocculus indicus* (also called *Cocculus levanticus* seu *piscatorius*) has considerable resemblance to the bay berry (*bacca lauri*), but is scarcely so large as the latter. It consists externally of a dried, thin, blackish-brown, rugous, acrid and bitter layer, which envelopes a thin, bivalved, white, ligneous shell (*endocarp*). In the middle of this shell arises a central placenta, which is contracted at its base, but enlarged and divided into two cells superiorly. Between this placenta and the shell is an oleaginous, yellowish, very bitter nucleus (*seed*) of a semilunar form. This nucleus never wholly fills the cavity of the shell,—at least in the Cocculus indicus of commerce; for by keeping, it gradually becomes atrophied, and in old samples it is not uncommon to find the shell almost empty. This change is observed also in other oleaginous seeds. By this character alone, Cocculus indicus may be instantly distinguished from the bay berry. The *Edinburgh College* requires that,—

> "The kernels should fill at least two-thirds of the fruit."

COMMERCE.—Cocculus indicus is imported in bags from Bombay, Madras, and Ceylon. I am not acquainted with any official returns of the quantity annually brought over. From a druggist's private books I find that, in 1834, about 2500 bags entered; and this probably is much below the quantity imported. The greater part is consumed for illegal purposes,—principally for adulterating beer and ale, though this practice is prohibited by the legislature, under a penalty of £200 upon the brewer, and £500 upon the seller of the drug.[3]

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[1] Venet. 1564.

[2] Lib. 2ndus, tr. 2ndus, cap. 488.

[3] [Among six samples of beer examined by Dr. Gerland, picrotoxine, indicative of the presence of cocculus indicus, was detected in four; but it was not known whether they were true commercial samples of beer, or intentionally adulterated, for the purpose of ascertaining the possibility of its detection. The mode of examination adopted was to evaporate the beer to dryness, treat the residue with ether, which dissolved out the picrotoxine, and on evaporation it was deposited in a crystalline state. (See *Pharmaceutical Journal*, vol. xv. p. 407, March 1856.)

Another plan consists in distilling over the alcohol, dissolving the extract in a small quan-

COMPOSITION.—Cocculus indicus was examined in 1811, by Boullay,[1] and in 1834 by Pelletier and Couerbe.[2] The results obtained by the last-mentioned chemists were as follows:—

Analysis of the Nucleus.

1. Picrotoxin.
2. Resin.
3. Gum.
4. A fatty acid substance.
5. An odorous matter.
6. Malic acid.
7. Mucus.
8. Starch.
9. Lignin.
10. Waxy matter.
11. Inorganic substances (nitrate and sulphate of potass, and chloride of potassium), by incineration carbonates of potash, and of lime, manganese, and iron.

Analysis of the Shell.

1. Menispermin.
2. Paramenispermin.
3. Yellow alkaline matter.
4. Hypopicrotoxic acid.
5. Wax.
6. Starch.
7. Chlorophylle.
8. Resinous matter.
9. Gum.
10. Fatty matter.
11. Inorganic substances (as those of the nucleus with the addition of copper).

1. PICROTOXINE (*Picrotoxic Acid*).—At first it was supposed to be an alkaline substance, and was termed *picrotoxia*. It is a white, crystalline, intensely bitter substance, usually crystallising in needles, but sometimes in silky flexible filaments, transparent plates or granular crystals. It is soluble in 150 parts of water at 57° F., in 25 parts of boiling water, in a third of its weight of alcohol, and in less than half its weight of ether. It is insoluble in the fixed and volatile oils, but is soluble in acetic acid. It does not combine with acids to form salts, but it forms combinations with alkalies. It seems, therefore, to be an acid, though a feeble one. It consists of $C^{12}H^{7}O^{5}$. The poisonous properties of the nucleus (seed) of cocculus indicus depend on picrotoxine. [According to Gregory, however, the formula is $C_{10}H_{6}O_{4}$. He observes that some recent researches tend to show that picrotoxine is a vegetable base. In regard to its chemical characteristics it may be stated that it is readily dissolved by water which contains a small quantity of soda, and when to this solution a few drops of sulphate of copper are added and the liquid gently warmed, red oxide of copper is thrown down, as with grape sugar. Ether is a good solvent of picrotoxine, but it does not readily remove this principle from its solution in soda. Dr. Glover has experimented on the properties of this substance, and has published an account of his experiments in the Lancet.[3] According to the analysis of Dr. Francis, it contains nitrogen, and it consists in 100 parts of carbon 60·26, hydrogen 5·70, nitrogen 1·30, oxygen 32·74.—ED.]

2. MENISPERMIA (*Menispermina; Menispermine*).—This is an opaque, white, crystalline substance, soluble in alcohol and ether, but insoluble in water. It fuses at 248° F., and at a higher temperature is decomposed, leaving an abundant charcoal. It dissolves in, and saturates acids; and from these solutions alkalies precipitate it. Concentrated sulphuric acid has little action on it: hot nitric acid converts it into a

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tity of water, and trying its effects on animals. Having experienced the symptoms caused by the presence of cocculus indicus in beer, we can corroborate the statement of the author, that its action mainly consists in depressing the action of the voluntary muscles. There is no stupor, but a kind of heaviness induced in which the person is conscious of all that is passing around him without having the power to move or rouse himself from his lethargic condition. It is our belief that the retailers of beer are in the habit of largely drugging it with an extract of cocculus indicus. This gives to it an apparent strength, thus making up for the lowering produced by the fraudulent dilution with a large quantity of water. It is disgraceful to our laws that an article which is used only for illegal purposes should be allowed to be imported. The nefarious adulterator, when detected, besides being fined and having his licence withdrawn, should be compelled to take a certain quantity of the prepared extract of his own beer, on the principle

> Nec lex justior ulla
> Quam necis artifices arte perire suâ.

This would soon put a stop to the practice."—ED.]

[1] *Ann. de Chim.* lxxx. 209.

[2] *Ann. Chim. et de Phys.* liv. 181.

[3] [*Lancet*, Jan. 11, 1851, p. 47.]

yellow resinous substance, and oxalic acid. It is composed, according to Gay-Lussac, of $C^{18}H^{12}NO^{2}$. It does not appear to have any marked action on the animal economy.

3. PARAMENISPERMIA (*Paramenispermina; Paramenispermine*).—This is a crystalline solid, insoluble in water, scarcely soluble in ether, but dissolving readily in alcohol. It is fusible and volatile, and may be sublimed unchanged. It does not neutralise acids, and, therefore, differs in this respect from the preceding substance. Notwithstanding this, however, its composition is the same.

4. HYPOPICROTOXIC ACID.—This acid is an amorphous, brown solid, insoluble in water (cold or boiling), insoluble in ether, soluble in alkalies, and precipitable from its solution in them by the mineral acids. It is composed of, *carbon* 64·14, *hydrogen* 6·09, *oxygen* 29·77. This composition approximates to that of picrotoxine.

The *yellow alkaline matter* of the shell has been scarcely examined.

Boullay[1] mentions a crystalline substance which he calls *menispermic acid;* but its properties require further examination.[2]

CHEMICAL CHARACTERISTICS.—Iodine colours the nucleus brown. The cold watery infusion of the whole fruit is slightly acid, and produces a dark precipitate with the sesquichloride of iron. Infusion of galls also occasions a precipitate.

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—A solution of the aqueous extract of Cocculus indicus killed a haricot plant in twenty-four hours.[3]

β. *On Animals generally.*—It is poisonous to all animals; at least it has been found to be poisonous to dogs, goats, cows, crocodiles, birds, and insects. Goupil[4] considered it to be a local irritant; but the correctness of this opinion is denied by Orfila.[5] When introduced into the stomach its irritant effects were confined to the production of nausea and vomiting. It acts on the cerebro-spinal system, causing staggering, trembling, tetanic convulsions, and insensibility. Goupil states, that all fish which eat it die,—roach being killed very easily, barbel with more difficulty. "The barbel," we are told, "is, of all fish, that whose flesh the most frequently occasions accidents in those animals who eat it; probably because these fish, taking a longer time to die, the poison is longer subjected to the action of the digestive juices, and a considerable quantity of it is consequently absorbed." Orfila says, Cocculus indicus acts like camphor on the nervous system, and principally on the brain.

γ. *On Man.*—Its effects on man have not been accurately ascertained. Hill[6] says, three or four grains of it have brought on nauseas and faintings. It is frequently added to malt liquors, for the purpose of increasing their intoxicating powers; but, from some accounts which I have received from an Excise officer, who has been repeatedly subjected to the influence of beer thus adulterated, its action appeared to be rather on the voluntary muscles than on the intellectual powers.[7] The operation of *Picrotoxine* is analogous to, though stronger than, that of Cocculus indicus. Ten or twelve grains, given by the mouth, are sufficient to kill a dog. A grain and a half, injected into the jugular vein of a dog, killed the animal in twenty minutes.

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[1] *Journ. de Pharm.* xiv. 61.

[2] See Casaseca, *Ann. Chim. et Phys.* xxx. 307.

[3] Marcet, *Ibid.* xxix. 215.

[4] Quoted by Orfila, *Toxicol. Gén.*

[5] *Ibid.*

[6] *Hist. of the Mat. Med.*

[7] [This agrees with our own experience of the effects of Cocculus indicus.—ED.]

USES—Cocculus indicus is rarely employed in medicine. It has, however, been used as an external application, in the form of powder or ointment, to destroy pediculi (hence the Germans call these fruits *Läusekorner*, or *louse-grains.*) It has been employed in some obstinate skin diseases, as porrigo; but its use requires caution, especially where the skin is not entire, on account of the danger of absorption. Notwithstanding the severe prohibitory statutes against the employment of Cocculus indicus in brewing, I have reason to believe that it is extensively used; but being employed in the form of a solution of the extract, the form is not easy of detection. Morrice[1] gives full directions for its employment. In the manufacture of porter, this author directs three lbs. of Cocculus indicus to be added to every ten quarters of malt. "It gives," says he, "an inebriating quality, which passes for strength of liquor;" and he adds, "that it prevents second fermentation in bottled beer, and consequently the bursting of the bottles in warm climates."

ANTIDOTE.—In poisoning by Cocculus indicus, or picrotoxine, remove the poison from the stomach as speedily as possible. No chemical antidote is known, though acetic acid has appeared to give relief. The symptoms must be combated on general principles, no peculiarities in the treatment being known. As a last resource, try artificial respiration.

UNGUENTUM COCCULI, E.; *Ointment of Cocculus Indicus.*—(Take any convenient quantity of Cocculus indicus, separate and preserve the kernels; beat them well in a mortar, first alone, and then with a little axunge, and then add axunge till it amounts, altogether, to five times the weight of the kernels).—Used to destroy pediculi.

Jäger[2] has an *ointment of picrotoxine* (composed of gr. x. of picrotoxine and ℥j. of lard) in obstinate forms of porrigo.

350. CISSAMPELOS PAREIRA, *Linn. E. D.*—PAREIRA BRAVA, OR VELVET LEAF.

Sex. Syst. Diœcia Monadelphia.
(Radix, *L.*—Root, *E. D.*)

HISTORY.—The root of this plant was first mentioned by Piso[3] in 1648, under the name of *Caapéba*. It was introduced into Paris in 1689, by M. Amelot, the French ambassador in Portugal.[4]

It is usually termed *Pareira* (Parreyra) *brava*, which means, literally, *wild vine*, on account of its supposed resemblance to the root of the wild vine. The Germans call it *Grieswurzel* (*i. e.* gravel root), on account of its beneficial effects in stone or gravel.

BOTANY. **Gen. Char.**—Diœcious. *Male: sepals* 4, in a double series. *Petals* 4, united into a cup-shaped corolla, with usually an entire margin. *Stamens* united into slender columns dilated at the apex, bearing two 2-celled anthers opening horizontally; cells placed end to end, and forming a 4-lobed, 4-celled annulus round the top of the column.

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[1] *Treatise on Brewing.*
[2] *Rust's Mag.* Bd. xiv. St. i. S. 105.
[3] *Hist. Nat. Brasil.* 94.
[4] Murray, *App. Med.* i. 499.

Female: calyx of 1! lateral sepal. *Corolla* of 1! petal in front of the sepal. *Ovary* solitary. *Stigmas* 3. *Drupe* obliquely reniform; but compressed, wrinkled round its margin. *Seed* solitary, uncinate; *embryo* long, terete, inclosed in a fleshy albumen (Wight and Arnott).

Sp. Char.—*Leaves* peltate, subcordate, ovate-articulate; silky-pubescent beneath. Female *racemes* larger than the leaf. *Berry* hispid (De Cand.)

A climbing *shrub*. *Root* woody, branching. *Stem* round, smooth, or with close-pressed down. *Leaves* aristate at the point, when full-grown smooth above, underneath covered with silky pubescence (hence called *velvet leaf*), but not truly downy. *Flowers* small, yellow. *Berry* scarlet, round or reniform, hispid.

Hab.—West India Islands and Spanish Main.

DESCRIPTION.—The root of Cissampelos Pareira, commonly termed *pareira brava* (*radix pareiræ bravæ*), is sometimes imported under the name of *abuta* or *butua root* (*radix butuæ*). Von Martius says, that in the Brazils, Cissampelos Pareira is called *Butua* or *Capeeba*. Pareira brava occurs in more or less cylindrical pieces, sometimes flattened, or bluntly angular. Some of the pieces are as thick as a child's arm,—their length often a foot or more. Externally they are covered with a dark-brown rind or cortex, which is furrowed longitudinally, and wrinkled transversely. The wrinkles have very much the appearance of large, transversely elongated lenticellæ. The surface of the transverse section of the root is of a yellowish grey colour, and presents a number of concentric circles (the annular layers), traversed by numerous radiating lines (medullary rays); between these lines are triangular bundles of woody fibres and ducts,—the latter are large, and being cut transversely, constitute the numerous holes or apertures presented by the cut surface. The circles or layers occasionally assume a very eccentric appearance.

The number of concentric circles varies with the age of the root. The fracture of the root is coarsely fibrous. The taste is sweetish, aromatic, afterwards bitter and unpleasant. It has no odour.

SUBSTITUTION.—The pareira brava of commerce yields most unequal quantities of extract. This circumstance, as well as some variation in the appearance of the pieces, leads to the belief that the roots (and stems?) of more than one plant, are sold under this name. A sample of a supposed spurious root,[1] yields "only a very minute quantity of the extract; and the decoction prepared from it, according to the usual formula, has only a slightly bitter taste, instead of the strong bitter of the decoctions" of the true root. A piece of this supposed spurious root presents an appearance of medulla, and is covered externally with a lichen; whence it would appear to be a portion of a stem.

COMPOSITION.—Pareira brava has been analysed by Feneuille,[2] who found the constituents to be, *a soft resin*, *a yellow bitter principle*, to which he ascribed the active properties of the root, *a brown colouring principle*, *vegeto-animal matter*, *fecula*, *super-malate of lime*, *nitrate of potash*, and some *ammoniacal and mineral salts*. More recently, Wiggers[3] has announced the discovery of a new vegetable alkali, which he calls *Cissampelin*, in this root.

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[1] See *Lond. Med. Gaz.* vol. xviii. p. 992; and vol. xix. p. 835.

[2] *Journ. de Pharm.* vii. 404.

[3] *Berl. Jahrb.* xl. 223, 1838 (from κίσσος, ivy; and ἄμπελος, vine).

[CISSAMPELIN OR PELOSIN ($C^{36}H^{21}NO^{6}$).—This alkaloid has been examined by Bödecker.[1] It forms about from four to five per cent. of the dried root of Pareira. It is an uncrystallisable alkaloid, insoluble in water, hot or cold, but soluble in alcohol and ether. It melts when heated, burns with a smoky flame, and leaves a carbonaceous residue. In solution it is rapidly decomposed (oxidised) when exposed to air. It combines with most acids, forming salts, which, with the exception of the hydrochlorate, are not crystallisable. They are, however, very soluble in water. The properties of the plant are owing to this alkaloid.—ED.]

CHEMICAL CHARACTERISTICS.—The presence of starch in the root is shown by iodine. An infusion of the root yields a precipitate on the addition of infusion of galls, and is rendered brown by the sesquichloride of iron.

PHYSIOLOGICAL EFFECTS.—I am unacquainted with any experiments made to determine the effects of this root in the healthy state of the body. From its taste, botanical affinities, and effects in diseases, it appears to possess a tonic power, and occasionally to act as a diuretic. Furthermore, its efficacy in certain maladies of the urinary organs induces us to ascribe an almost specific influence to this root over the mucous membrane lining the urinary passages. It certainly does appear to have the power of altering the quality of the urinary secretion. Large doses prove aperient.

USES.—It was originally introduced into medicine as a lithontriptic. Its powers in this way were at one time highly vaunted, and Helvetius even went so far as to assert that calculi, the size of an olive, had disappeared under its use, and that the operation of lithotomy was no longer necessary! We now employ it almost solely *in discharges from the urino-genital mucous membrane.*—It has been used in gonorrhœa, leucorrhœa, and chronic inflammation of the bladder. In the latter of these diseases Sir B. Brodie[2] states, that he has seen more good done by this root, than by the Uva-ursi. "I am satisfied," says this eminent surgeon, "that it has a great influence over the disease which is now under consideration, lessening very materially the secretion of the ropy mucus, which is itself a very great evil, and, I believe, diminishing the inflammation and irritability of the bladder also." He recommends it to be taken in the form of a concentrated decoction, to which may be added some tincture of hyoscyamus; and in those cases in which there is a deposit of the triple phosphates, muriatic or diluted nitric acid may be added.

ADMINISTRATION.—The *powder* has been given in doses of from half a drachm to a drachm. But the *infusion* or *decoction*, to which some *extract* has been added, is to be preferred. A *tincture* or *essence* has been prepared by digesting one part of the root in five parts of rectified spirit. It is reputed diuretic and anticatarrhal. Its dose is fʒj.

1. DECOCTUM PAREIRÆ, L.; *Decoction of Pareira.* (Pareira, sliced, ʒx.; Distilled Water, Oiss. Boil to a pint and strain.) [Narcotics, especially hyoscyamus, as well as alkalies or acids, may be added to this decoction as occasion may require. Sir Benjamin Brodie recommends as a preferable formula ℥ss. of the root to Oiij. of water, to be gently boiled down to one pint. Eight to twelve ounces of this decoction should be taken daily. This is certainly a more effective preparation than that of the Ph. L.—ED.]

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[1] [Schwarzkopf, *Chemie der Organischen Alkalien*, 1855, 416.—ED.]

[2] *Lond. Med. Gaz.* i. 300.

2. **INFUSUM PAREIRÆ**, E. D.; *Infusion of Pareira Brava.*—(Pareira, ʒvj.; Boiling Water, Oj. Macerate for two hours in a lightly covered vessel, and strain through calico, *E.*)—Dose, f℥j. to f℥iij. It will be advisable to increase the strength of this infusion by the addition of some extract of Pareira to it. The Dublin College orders ℥ss. of the bruised and torn root to ℥ix. of boiling water, and macerates for one hour.

3. **EXTRACTUM PAREIRÆ**, L. E.; *Extract of Pareira Brava.* (Prepared as Extract of Hæmatoxylon [as Extract of Liquorice-root, *E.*])—Dose, gr. x. to ʒss. It is usually given in conjunction with the infusion or decoction.

OTHER MEDICINAL MENISPERMACEÆ.

The student must not confound PAREIRA BRAVA with the PAREIRA BARK belonging to Strychnaceæ and before noticed, nor with the PAREIRA MEDICA, Lindley,[1] a menispermaceous plant, whose root is employed by the Cingalese as a stomachic.

ORDER LXXXVI. MAGNOLIACEÆ, *De Candolle.*—THE MAGNOLIA TRIBE.

MAGNOLIACEÆ and WINTERACEÆ, *Lindley.*

CHARACTERS.—All the parts of the flower disposed in ternary number. *Sepals* 3 to 6, deciduous. *Petals* 3 to 27, in many series, hypogynous. *Stamens* numerous, free, inserted on the torus beneath the ovaries; *anthers* adnate, elongated. *Ovaries* numerous, inserted on the torus above the stamens, generally disposed like a spike, monostylous; *styles* short; *stigmas* simple. *Carpels* as many as the ovaries, 1-celled, 1- or many-seeded, capsular, and dehiscing by a superior chink; or capsular bivalved, dehiscing by an inferior chink; or follicular; or somewhat fleshy and indehiscent; or, lastly, samariform, aggregate, or partially united into a loose or dense strobile. *Seeds* attached to the internal angle of the carpels; *albumen* fleshy; *embryo* straight, small, inferior.—Elegant *trees* or *shrubs*. *Leaves* alternate, pinnatinerved. *Flowers* conspicuous, often powerfully odoriferous (De Cand.).

PROPERTIES.—Bark tonic and aromatic. The same properties are possessed by some of the fruits. The flowers by their odour readily occasion nausea, headache, and faintness.

351. DRIMYS WINTERI, *De Candolle.*—WINTER'S BARK TREE.

Wintera aromatica, *Murray.*

Sex. Syst. Polyandria Tetragynia.

HISTORY.—William Winter, captain of one of the ships which accompanied Sir Francis Drake, in the year 1578, to the Straits of Magellan, returning in 1579, brought the bark of some trees, which he had cut down there, to Europe. From this circumstance Clusius[1] called it *Winter's bark* (*Winteranus cortex*). It was afterwards confounded with Canella bark.

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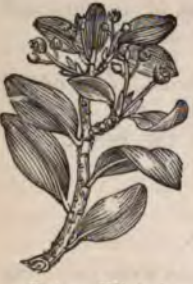
[1] *Fl. Med.* 370.

BOTANY. **Gen. Char.**—Carpels congested, baccate, many-seeded. *Filaments* thickest at the apex; cells of the anther separate (De Cand.).

Sp. Char.—*Leaves* oblong, obtuse, glaucous beneath. *Peduncles* simple, approximated, or very short, divided into elongated pedicels (De Cand.).

FIG. 107.



Drimys Winteri.

A large forest *tree.* *Branches* often tuberculated from the scars of the old footstalks. *Sepals* 2 to 3, green. *Petals* 7, milk-white. *Fruit* ovate.[2]

Hab.—Straits of Magellan, Chili, Peru, New Grenada.

DESCRIPTION.—Winter's bark (*Cortex Winteri* seu *Winteranus*) occurs in quills or rolled pieces, commonly a foot long, one or two inches in diameter, and two or three lines thick. Its colour externally is pale yellowish, or dull reddish-grey, with red elliptical spots; internally it is reddish brown. Its odour is aromatic, its taste warm and pungent. The characters by which it is distinguished from Canella bark have been already pointed out. Its infusion is darkened by the salts of iron.

COMPOSITION.—Winter's bark has been analysed by M. Henry,[3] who found its constituents to be *resin, volatile oil, colouring matter, tannin, acetate of potash, chloride of potassium, sulphate of potash, oxalate of lime,* and *oxide of iron.*

1. VOLATILE OIL (*Oleum Corticis Winteri*).—Pale-yellow, lighter than water, with a very hot and acrid taste. By standing it is separated into two parts: one (the most abundant part) a greenish-yellow liquid; the other (heavier, but lighter than water) white, and of a fatty consistence.

2. RESIN.—Reddish-brown and almost odourless. Its taste is at first feeble; then acrid and persistent.

PHYSIOLOGICAL EFFECTS AND USES.—Stimulant, aromatic, and tonic. Its uses are similar to those of cinnamon and canella alba. Winter employed it in scurvy. It is seldom employed.—Dose, ʒss. or ʒj.

[352. MAGNOLIA GLAUCA, *Linn.*

(Magnolia, *U. S.* Sec. List.)

This is usually a small tree, the height of which varies from 10 to 30 feet, branching, with a smooth, glaucous, whitish bark. The *leaves* are from three to five inches long, and an inch and a half to two inches wide, nearly elliptical, rather acute, sometimes obtuse, shining green

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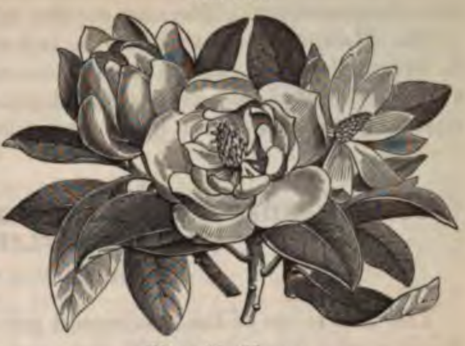
[1] *Exot.* lib. iv. cap. i. p. 75.

[2] See Solander's *Med. Observ. and Inq.* vol. v. p. 41.

[3] *Journ. de Pharm.* t. v. p. 489.

Fig. 108.



Magnolia Glauca.

above, very glaucous beneath, and when young, the under surface clothed with a glaucous, silky pubescence. *Petioles* three-quarters of an inch long. *Flowers* very fragrant, on thick, clavate, pubescent peduncles, about half an inch in length. *Sepals* oblong, concave, roughish, dotted, as long as the petals. *Petals* white, an inch or an inch and a half long, obovate. *Stamens* numerous; *filaments* short, with the point extending above the adnate anthers. *Ovaries* collected in an ovoid cone; *styles* very short, recurved. *Carpels* opening longitudinally. *Seeds* obovate, covered with a purple fleshy arillus, falling out of the carpels when mature, and hanging for some time by a long filiform funiculus. (Darlington, *Flora Cestrica.*) *Sex. Syst. Polyand. Polygyn.*

This plant is abundant along the Atlantic coast of North America, from Massachusetts to Florida, where it frequents thick swamps and morasses; it does not grow spontaneously in dry and argillaceous ground unless transplanted. It is readily detected when in bloom by the rich perfume of its handsome white flowers; this occurs in May and June. The glaucous leaves and white shining bark at other seasons serve to distinguish it from the trees with which it grows. In the Southern States it is called *White Bay* and *Sweet Bay*. The bark is taken off during the spring and summer. When dried, it is in pieces several inches in length, and an inch or two broad, somewhat rolled, light; ashen, smooth and silvery externally, white and fibrous internally. It has an aromatic odour, which is impaired by time, and a taste warm, pungent, and bitterish. The bark of the root has similar properties, and is regarded as being superior to that of the trunk and branches; it is rough externally. No detailed account has been given of its chemical composition; it is probable that an active principle, similar to *Liriodendrine*, found in the *M. grandiflora*, by Mr. Stephen Procter,[1] is also to be found in this species. Magnolia is tonic and diaphoretic in its effects on the animal economy, and may be used in cases where these effects are available. Its employment has been beneficial in the treatment of chronic rheumatism, and has proved serviceable in arresting the paroxysms of intermittent fever. The dose is ʒss. to ʒj. in powder; or a decoction may be made in the proportion of ℥j. to Oj.—Dose, ℥j. or ℥ij. An infusion in brandy is sometimes used in rheumatism.

The M. ACUMINATA, *Cucumber Tree*, officinal in *U. S. Pharm.*, is a large tree, inhabiting the mountainous districts of the United States; and the M. TRIPETALA (*Umbrella Tree*), also officinal, U.S., is a much smaller tree. The bark of both affords the officinal drug in common with the preceding. The uses are the same.

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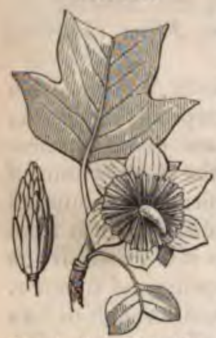
[1] *Am. Journ. of Pharm.* vol. xiv. p. 95.

The MAGNOLIA GRANDIFLORA is deserving of a similar rank. Mr. S. Procter (*op. cit.*) found the bark to contain *green resin*, *volatile oil*, and a peculiar *crystallisable principle* analogous to *Liriodendrine*, an *acid* precipitating the salts of iron green, and *salts*.—ED.]

[353. LIRIODENDRON TULIPIFERA, *Linn.*—AMERICAN POPLAR TULIP TREE.

(Liriodendron, *U. S.* Sec. List.)

FIG. 109.



Liriodendron Tulipifera.

This tree is one of the handsomest peculiar to the United States. Its height varies from 60 to 100 feet, and it is often four or five feet in diameter. In the old trees the branches are spreading at the summit, and frequently of great height without branches; in the young trees the branches are in the form of a cone. *Buds* large, compressed, obovate. *Leaves* three to five inches long, and four to six inches broad, nearly quadrangular in their outline, smooth, shining green above, paler beneath, rounded or subcordate at base, with a short, diverging, acuminate lobe (sometimes two) on each side, and the broad central lobe emarginately truncated. *Petioles* two or three inches long. *Flowers* large, campanulate, each with two caducous *bracts* at base. *Sepals* obovate-oblong, concave, pale yellowish-green, as long as the petals, spreading, and at length reflexed, deciduous. *Petals* lance-obovate, mostly obtuse, greenish-yellow, stained with reddish-orange below the middle. *Stamens* in a simple series, shorter than the petals; *filaments* with a lance-ovate point extending above the long adnate anthers. *Ovaries* closely imbricated; *stigmas* sessile, recurved. *Carpels* two-celled, samara-like, with a lance-oblong wing at apex, incurved at base, with a prominent internal ridge, imbricated in a cone upon a slender fusiform receptacle; one of the cells frequently obliterated, and both seeds often abortive. (Darlington, *Flor. Cest.*) *Sex. Syst. Polyand. Polygyn.* It is called *Tulip Tree* on account of its numerous, large, showy, orange-coloured, tulip-shaped flowers. According to *Michaux*, the northern limit of this tree may be placed at the southern extremity of Lake Champlain, lat. 45°, and it seldom is found east of the Connecticut River. It is found abundantly through the Middle and Southern States, requiring a rich, not too moist, soil.

The bark of the trunk and larger branches is very rough, and covered with dead epidermis, which is very much split and divided; upon the smaller branches it is smooth, and of a deep ashen hue. It is brought into the market in pieces of three or four inches long, deprived of epidermis, and of a yellowish-white colour, light, fibrous, and easily broken; the odour is somewhat aromatic; the taste pungent, aromatic, slightly camphorous, and bitter. The bark obtained from the root has similar properties, but is browner and rougher externally.

A peculiar principle (*Liriodendrine*) has been obtained from this bark by the late Prof. Emmet,[1] of the University of Virginia. It is a crystalline solid, bitter and inodorous at 40°, fusible at 180°, and volatile at 290° F. When carefully heated in a glass tube closed at one end, it gives off a white vapour, which condenses again, without signs of crystallisation. It is not acid or alkaline. Its discoverer regarded it as a substance analogous to camphor.

USES.—The medicinal properties of Liriodendron are those of a stimulant and tonic; in large doses it is diaphoretic, and is also stated to be diuretic. As a febrifuge it has been employed by a number of American physicians; but as it is stimulant, and apt to sicken the stomach, or to act upon the bowels, the condition of the organs is to be strictly inquired into, and the system prepared for its employment. Dr. Young regarded it as also beneficial in hysteria, and as an anthelmintic. The dose in substance is ℈j. to ʒij. In this form it acts with most power. As it yields its virtues to water and alcohol, it may be exhibited either in infusion, decoction, or tincture. There are no officinal preparations. —ED.]

OTHER MEDICINAL MAGNOLIACEÆ.

ILLICIUM ANISATUM is an evergreen tree, growing in Japan and Cochin-China. Its fruit constitutes the *star-anise* (*anisum stellatum*) of the shops. It consists of a variable number (usually six to twelve) of hard woody follicles, disposed in a star-like form, each containing an oval reddish seed. It has the odour of common anise (*Pimpinella Anisum*), but somewhat sweeter. By distillation it yields the *oil of star-anise* (*oleum badiani*), which closely resembles, and is often substituted for, the oil of common anise; but it congeals less readily than the latter. Star-anise is aromatic and carminative. Both the fruit and the oil are employed by liqueur-makers. As regards its effects it might be substituted for common anise.

[Star-aniseed is imported chiefly from China and Singapore. The importations in ten years, 1835 to 1844, amounted to 8961 chests, making an average of 896 chests per annum. More recently the importations have been as follows:—

	Chests.		*Chests.*
1850	223	1852	544
1851	413	1853	361

Taking the average of four years ending 1854, the importations were 332 chests per annum. The greater part is exported to the continent, where it is used as a spice in most households. Some remarks have elsewhere been made concerning its oil (see Oleum Anisi, *ante*, p. 163.) This oil is imported in tins, packed in cases holding sixty pounds. It is largely consumed in Italy for making aniseed water, which is there much used as a cooling drink. It is also used in flavouring liqueurs.—ED.]

ORDER LXXXVII. RANUNCULACEÆ, *De Candolle.*— THE CROW-FOOT TRIBE.

CHARACTERS.—*Sepals* 3 to 6, hypogynous, deciduous, generally imbricate in æstivation, occasionally valvate or duplicate. *Petals* 3 to 15, hypogynous, in one or more rows, distinct, sometimes deformed. *Stamens* definite or indefinite in number, hypogynous; *anthers* adnate. *Carpels* numerous, seated on a torus, 1-celled or united into a single many-celled pistil; *ovary* 1 or more seeded, the *ovules* adhering to the inner edge; *style* 1 to each ovary, short, simple. *Fruit* either consisting of dry akenia or baccate with 1 or more seeds, or follicular with 1 or more valves. *Seeds* albuminous; when solitary, either erect or pendulous; *embryo* minute; *albumen* corneous. —*Herbs*, or very rarely *shrubs*. *Leaves* alternate or opposite, generally much divided, with the petiole dilated and forming a sheath half-clasping the stem. *Stipules* occasionally present. *Hairs*, if any, simple. *Inflorescence* variable (*Lindley*).

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[1] *Journ. of Phil. Col. of Pharm.* vol. iii. p. 5.

PROPERTIES.—Mostly poisonous. Acridity is the prevailing quality, conjoined, in a considerable number of instances, with a narcotic quality. Several of the species are topical benumbers.

354. RANUNCULUS ACRIS, *Linn.*—UPRIGHT MEADOW CROWFOOT.

Sex. Syst. Polyandria Polygynia.

BOTANY. **Gen. Char.**—*Calyx* of 5 sepals; sepals not separate at the base, deciduous. *Petals* 5, rarely 10, with nectariferous scales at the base. *Stamens* and *ovaries* numerous. *Caryopsides* ovate, somewhat compressed, terminating in a short mucro or horn, scarcely larger than the seed, smooth, striated or tuberculated, arranged in a globose or cylindrical head (De Cand.).

Sp. Char.—*Calyx* spreading. *Flower-stalks* round and even. *Leaves* in three deep-lobed and cut segments; those of the uppermost linear and entire. *Stem* erect, covered with close hairs.[1]

Perennial. *Flowers* yellow. *Petals* with a scale at the base.

Hab.—Indigenous; very common in meadows and pastures. Flowers in June and July.

COMPOSITION.—Not analysed. Its *acrid principle* is either very volatile, or readily undergoes decomposition, as by drying, the plant loses its acridity.

PHYSIOLOGICAL EFFECTS.—A powerful acrid. Inflammation of the palm of the hand has been produced by pulling it up and carrying it a little distance.[2] Withering[3] says it easily blisters the skin. Orfila[4] has shown, by experiments on animals, its power of causing inflammation of the tissues to which it is applied.

USES.—It has been applied as a rubefacient and epispastic, but is far inferior to cantharides and mustard, on account of the uncertainty of its operation.

355. RANUNCULUS FLAMMULA, *Linn.*—LESSER SPEAR-WORT CROWFOOT.

Sex. Syst. Polyandria Polygynia.

BOTANY. **Gen. Char.**—See *Ranunculus acris.*

Sp. Char.—*Leaves* ovate-lanceolate, bluntish stalked. *Stem* reclining. *Root* fibrous. *Seeds* smooth (Smith).

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[1] Smith, *Eng. Fl.*

[2] Curtis, *Fl. Lond.* vol. i.

[3] *Arrang. of Brit. Plants*, iii. 681.

[4] *Tox. Gén.*

Perennial. *Leaves* nearly entire, subserrate. *Flowers* bright gold colour.

Hab.—Indigenous; sides of lakes and ditches abundant.

PHYSIOLOGICAL EFFECTS AND USES.—Similar to those of *Ranunculus acris.*

356. HELLEBORUS NIGER, *Linn. L. E.*—BLACK HELLEBORE, OR CHRISTMAS ROSE.

Sex. Syst. Polyandria Polygynia.

(Rhizoma et radix, *L.*—Root, *E.*)

HISTORY.—According to Sprengel,[1] this is the plant called by the Abbess Hildegard, *Christiana.*

It must not be confounded with the ἐλλέβορος μέλας (*black hellebore*) of Dioscorides,[2] which, according to Dr. Sibthorp,[3] was the plant which he has described and figured under the name of *Helleborus officinalis.* Hippocrates employed hellebore in medicine. Melampus employed it with great success, in the treatment of madness, 1400 years before Christ. His use of it is the earliest instance on record of the use of a purgative.[4] It has been called after him *melampodium,* a term which has also been applied to Helleborus niger.

BOTANY. **Gen. Char.**—*Calyx* persistent, of 5 sepals; sepals roundish, obtuse, large, usually green. *Petals* 8 to 10, very short, tubular, narrow, and nectariferous beneath. *Stamens* 30 to 64. *Ovaries* 3 to 10. *Stigmas* terminal, orbicular. *Capsules* coriaceous. *Seeds* in a double row, elliptical, umbilicated (De Cand.).

Sp. Char.—*Leaves* radical, pedatisect, quite smooth. *Scape* leafless, 1- to 2-flowered, bracteate (De Cand.).

Rhizome several inches long, tuberculated, horizontal, scaly, blackish-brown externally, white internally, with many dependent, long, simple root-fibres. *Leaves* on cylindrical stalks from 4 to 8 inches long; lobes ovate-lanceolate, serrate near the point. *Scape* shorter than the petiole. *Sepals* ovate or roundish, large, white, slightly tinged with pink, eventually becoming green. *Petals* green, tubular, shorter than the stamens. *Follicles* many-seeded. *Seeds* black, shining.

Hab.—Sub-alpine, woodland regions in the midland and southern parts of Europe.

COMMERCE.—Hellebore root is imported in barrels and bags from Hamburgh usually, but sometimes from Marseilles.

DESCRIPTION.—The root met with in commerce under the name of black hellebore root (*radix hellebori nigri,* seu *radix melampodii*) consists of two parts,—the rhizome or rootstock, and the fibres which arise from it. The rhizome is half an inch or less thick, several inches long, horizontal or contorted, knotty, with transverse ridges and slight longitudinal striæ. The fibres are numerous, cylindrical, dark brown externally, internally whitish or yellowish white, with a central paler cord. The odour is very feeble, and scarcely perceptible, but has been compared to that of senega root. Its taste is slight at first, then bitterish, acrid and nauseous.

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[1] *Hist. Rei Herb.* i. 226.

[2] Lib. iv. cap. 151.

[3] *Fl. Græca.*

[4] Le Clerc, *Hist. de la Méd.* p. 27, 1729.

SUBSTITUTION.—It is probable that the roots of *Helleborus viridis* and *fœtidus* are sometimes substituted for, or intermixed with, black hellebore root. This practice certainly occurs on the continent. The root of *Actæa spicata* (sometimes called *radix hellebori nigri falsi*) is also said to be occasionally substituted for the genuine root: its stronger fibres, when cut transversely, present the form of a cross. As far as I have observed, the roots, sold in this country as black hellebore, have a very uniform appearance, and from this I have not had reason to suspect any intermixture of other roots.

COMPOSITION.—Vauquelin[1] analysed the root of *Helleborus hiemalis*. This analysis is quoted by Soubeiran[2] as the analysis of black hellebore root. Feneulle and Capron[3] analysed the black hellebore root.

Vauquelin's Analysis.	*Feneulle and Capron's Analysis.*
Very acrid oil.	Volatile oil.
Extractive.	Fatty oil.
Starch.	Volatile acid.
Vegeto-animal matter.	Resinous matter.
Sugar.	Wax.
Lignin.	Bitter principle.
	Ulmin.
	Gallate of potash.
	Ammoniacal salts.
Root of Helleborus hiemalis.	Root of Helleborus niger.

1. ACRID OIL, Vauquelin; *Soft Resin*, Gmelin; *Helleborin.*—This substance is odourless, has an acrid taste, and is soluble in spirit. Vauquelin ascribed the activity of hellebore to it. Feneulle and Capron, on the other hand, ascribe it to a combination of *fatty oil* and *volatile acid.* Probably the two latter correspond to the acrid oil of Vauquelin or the Helleborin of Gmelin.

[2. HELLEBORINE.—Mr. Bastick has succeeded in extracting from hellebore root a neutral crystallisable principle, which he proposes to call Helleborine, withdrawing that name from the *soft resin* described by Gmelin. A very strong tincture of the bruised root is made in the usual way. This is filtered, diluted with water and heated for some time to expel the alcohol. The aqueous solution is then filtered to remove the resin and afterwards concentrated by evaporation. Carbonate of potash is now added in excess and the solution shaken with four times its volume of ether, and by the evaporation of the ethereal solution the helleborine was obtained. It was purified by recrystallisation from alcohol. Helleborine thus obtained was in white translucent crystals slightly soluble in water, more soluble in ether, and readily soluble in alcohol. It is bitter to the taste, producing on the tongue a tingling sensation. Strong sulphuric acid decomposes it and produces with it a reddish-brown solution. Nitric acid dissolves it but oxidises it only by heat. It is not volatile but decomposed by heat. It is neutral and does not combine with acids or alkalies. That it contains nitrogen is proved by the evolution of ammonia when it is heated in a dry state with caustic potash. It resembles piperine in some of its properties. It has not been submitted to ultimate analysis, and its medicinal properties have not been examined.[4]—ED.]

PHYSIOLOGICAL EFFECTS. α. *On Animals.*—Given by the mouth to the carnivora (as dogs), it causes vomiting, frequently purging and griping. In excessive doses it produces gastro-enteritis. If the œsophagus be tied, to prevent the ejection of the root from the stomach, it causes staggering, weakness or paralysis of the hind extremities, insensibility, and death. Similar effects result from its application to a wound.[1] Orfila states, when the animals survive a few hours, inflammation of the rectum is a constant occurrence; whereas Vicat[2] says it causes inflammation of all the intestines, except only the rectum. The latter statement is entirely erroneous.

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[1] *Ann. de Muséum*, viii. 87.

[2] *Nouv. Traité de Pharm.* i.

[3] *Journ. de Pharm.* viii. 503.

[4] [*Pharmaceutical Journal*, vol. xii. p. 274.]

β. *On Man.*—Black hellebore is a local irritant, drastic purgative, and emmenagogue. Given in *small doses* it increases the secretion and peristaltic motion of the intestines, and acts as a stimulant to the pelvic circulation, thereby promoting the menstrual and hemorrhoidal discharges, and by its influence over the portal circulation contributing probably to increase the hepatic secretion. *Large doses* act as a drastic purgative, and frequently also occasion sickness. They produce a more manifest influence over the pelvic vessels, often cause cold sweats, and lower the strength of the pulse. In an *excessive* or *poisonous dose* it acts as a narcotico-acrid poison, and causes vomiting, purging, burning pain in the stomach and intestines, cramps of the lower extremities, cold sweats, faintness, paralysis, insensibility, and death. The fresh root *applied to the skin* produces rubefaction and vesication.

As a drastic purgative it is allied to colocynth, from which its narcotic operation and its greater influence over the pelvic organs distinguish it.

USES.—Black hellebore, though greatly esteemed by the ancients, is but little employed by the moderns. It is adapted for torpid, phlegmatic individuals, especially when the pelvic circulation is languid. On the other hand, in easily-excitable persons, and where any irritation of the pelvic organs (especially the uterus and rectum) exists, it proves injurious.

1. *In affections of the nervous system*, especially mania, melancholia, and epilepsy, it has long been celebrated, and, under the above-mentioned conditions, at times proves serviceable.

2. *As an emmenagogue* it was greatly esteemed by Dr. Mead,[3] and is still much valued by some practitioners. He gave two teaspoonfuls of the tincture in a glass of warm water twice a day. The remarks already made will readily suggest the class ot cases to which it is applicable.

3. *In dropsy* its drastic operation renders it useful. Furthermore, when this disease depends on, or is connected with, a languid state of the portal circulation, black hellebore proves useful by the stimulus which it communicates to the hepatic vessels.

4. Lastly, black hellebore has been used in *chronic skin diseases*, and as an *anthelmintic*.

ADMINISTRATION.—The dose of powdered hellebore is from grs. x. to ℈j. as a drastic purgative. When we require a milder effect, we may give it in doses of grs. iij. to grs. viij. It has also been given in decoction; but the tincture is the most frequently employed preparation.

TINCTURA HELLEBORI, L.; *Tincture of Black Hellebore.* (Hellebore, bruised, ℥v.; Proof Spirit, Oij. Macerate for seven days, and strain).—Dose, fʒss. to fʒj. Principally employed as an emmenagogue.

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[1] Orfila, *Toxicol. Gén.*; Schabel, quoted by Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. 11.

[2] *Hist. des Plant. Vén. de la Suisse*, p. 69.

[3] *Works*, p. 563, 1762.

357. DELPHINIUM STAPHYSAGRIA, *Linn. L. E.*— STAVESACRE.

Sex. Syst. Polyandria Trigynia.

(Semina, *L.*—Seeds, *E.*)

HISTORY.—Hippocrates employed stavesacre in medicine. Sibthorp[1] found the plant growing in Crete and Zante, and identified it with the *σταφὶς ’αγρία* of Dioscorides.[2]

BOTANY. **Gen. Char.**—*Calyx* deciduous, petaloid, irregular; the *sepals* elongated at the base into a spur. *Petals* 4, the two upper appendiculated within the spur (De Cand.).

Sp. Char.—*Spur* very short. *Bractlets* inserted at the base of the pedicel. *Petioles* pilose. *Pedicels* twice as long as the flower (De Cand.).

A stout *herb*, one or two feet high. *Stem* and *petioles* hispid, with soft hairs. *Leaves* broad, palmated, stalked, 5- to 9-cleft. *Racemes* lax. *Flowers* bluish or purplish. *Capsules* 3, large.

Hab.—South of Europe, the Levant, and the Canaries.

DESCRIPTION.—Stavesacre seeds (*semina staphisagriæ* seu *staphidis agriæ*) are irregularly triangular (sometimes quadrangular), slightly arched, blackish-brown, and wrinkled. They contain a white and oily nucleus. Their odour is slight but disagreeable; their taste bitter, very acrid, hot, and nauseous. Iodine colours the seeds brown. Their watery infusion is darkened by sesquichloride of iron. Infusion of nutgalls renders it turbid.

COMPOSITION.—Stavesacre seeds were analysed in 1820 by Brandes,[3] and in 1821 by Lassaigne and Feneulle.[4]

Brandes's Analysis.	
Delphinia	8·10
Fatty oil	19·10
Waxy substance	1·40
Gum	3·15
Starch	2·40
Woody fibre	17·20
Phytocol *with salts*	30·67
Vegetable albumen	3·70
Sulphates and phosphates of lime, potash, and magnesia	5·77
Water	10·00
Stavesacre Seeds	100·49

Lassaigne and Feneulle's Analysis.
Malate of delphinia.
Volatile oil.
Fatty oil.
Brown bitter matter.
Yellow ditto.
Uncrystallisable sugar.
Gum.
Woody fibre.
Animal matter.
Albumen.
Mineral salts.
Stavesacre Seeds.

1. DELPHINIA (*Delphina; Delphine; Delphinum*).—As usually met with, this is a white, odourless powder. Its taste is extremely acrid and very bitter. It is scarcely soluble in water whether hot or cold, but dissolves in ether, and still better in alcohol. Its alcoholic solution reacts as an alkali on test-paper. It is not crystallisable, though its texture is said to be crystalline, when the powder is moistened. It saturates acids, forms salts which are acrid, very bitter, and difficultly crystallisable. From its solution in acids it is precipitated by alkalies. Its composition is $C^{27}H^{19}NO^{7}$. Its

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[1] *Prodr. Fl. Græcæ*, i. 372.

[2] Lib. iv. cap. 156.

[3] Gmelin, *Handb. d. Chem.* ii. 1240.

[4] *Ann. de Chim. et de Phys.* xii. 358.

atomic weight, therefore, is 211. Couerbe[1] says that, as usually procured, it is not absolutely pure, but contains a resinous matter, and an acrid resin which he calls *staphysain.*

2. VOLATILE ACID (*Delphinic Acid?*).—Discovered by Hofschläger.[2] It is white, crystalline, volatile at a low temperature, and in small doses is a powerful emetic.

PHYSIOLOGICAL EFFECTS.—The activity of stavesacre seeds depends partly on the delphinia and partly on the volatile acid. The powder of the seeds readily excites nausea, vomiting, and purging. Orfila[3] has shown that on dogs it acts first as an acrid, and afterwards as a narcotic poison. Its operation appears to be similar to cebadilla.

USES.—Stavesacre seeds have been used to destroy pediculi; whence the Germans term them *Läusesaamen*, or *louse-seeds.* For this purpose they are employed in the form of ointment or acetous infusion. They have also been administered internally (in doses of from three to eight grains) against worms, and externally in the form of decoction (prepared by boiling ℥j. of the seeds in Oij. of water) in inveterate itch.

ANTIDOTE.—See *Veratrum album.*

[**DELPHINIA.**—($C_{27}H_{19}NO_7$.) *Delphinia.* This alkaloid was discovered in 1819, by Brandes, Lassaigne, and Feneulle. It is extracted from the bruised seeds of the plant. They are treated with diluted sulphuric acid, and the filtrate is precipitated by ammonia or carbonate of potash. The precipitate (*impure delphinia*) is dissolved in hot alcohol, filtered and evaporated. The residue is dissolved in hydrochloric acid and the solution decomposed by magnesia. The precipitate by one or two digestions in alcohol is obtained pure.

PROPERTIES.—Not generally seen crystallised but as a yellowish white powder. Schwarzkopf procured it by spontaneous evaporation from its alcoholic solution in very minute crystals apparently belonging to the rhombohedral system.[4] Delphinia, as a powder, is nearly white: it has an acrid, persistent hot taste, is almost insoluble in water but gives to it a decided taste. It is easily dissolved by ether and the oils. At 60° six parts of alcohol dissolve one part; at a higher temperature much more. The powder applied to the nose produces the most violent sneezing, and when applied to the eye, great irritation followed by inflammation. It melts at 248° and is decomposed at a higher temperature. Sulphuric acid gives an intense blood-red colour with delphinia, passing into a dirty brown, and ultimately becoming black from carbonisation. Cold nitric acid gives to it an ochreous, and, after a time, a dingy red colour; when heated it is destroyed, and changed to a bitter acid resinous looking mass. An alcoholic solution of Delphinia has an alkaline reaction. This alkaloid combines with the diluted acids to form very soluble salts.—ED.]

MEDICINAL USES.—Four grains of delphinia dissolved in a drachm of rectified spirit produce, when rubbed on the skin, a sensation of burning and pricking, with tingling and slight redness. Taken internally, in doses of half a grain, it sometimes acts slightly on the bowels, and increases the flow of urine. In larger doses, as a few grains, it gives rise to sensations of heat and tingling in various parts of the body.[1] The diseases in which it is chiefly successful are neuralgic cases. It has also been used in rheumatic affections with some benefit. It is employed externally in the form of ointment or alcoholic solution.

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[1] *Journ. de Pharm.* xiii. 365.

[2] *Ann. Chim. et de Phys.* l. 2.

[3] *Toxicol. Gen.*

[4] [*Chemie der organischen Alkalien*, 1855, p. 382.]

UNGUENTUM DELPHINIÆ consists of ʒss. of delphinia, ʒj. of olive oil, and ℥j. of lard. The *Solutio delphiniæ* composed of ℈j. of delphinia dissolved in f℥ij. of rectified spirit, is an excellent embrocation. Internally, delphinia is given in the form of pills. The *Pilulæ delphiniæ*, consist of gr. j. of delphinia; grs. xij. extract of hyoscyamus; and the same quantity of extract of liquorice. Divide the mass into twelve pills, one of which may be taken every three hours (Turnbull).

358. ACONITUM NAPELLUS, *Linn. L. E. D.*—COMMON WOLFSBANE, OR MONKSHOOD.

Sex. Syst. Polyandria Trigynia.

(Folium recens et exsiccatum; Radix, *L.*—Leaves, *E.*—The Root, *D.*)

HISTORY.—The ancient history of Aconite is involved in great obscurity. The Greeks make frequent reference to a most virulent poison which they term ἀκόνῖτον. Theophrastus[2] is the earliest writer who speaks of it. As *Aconitum Napellus* is a virulent poison, and is a native of Greece, where it is known at the present day as ἀκόνῖτον,[3] it would at first appear probable that our common aconite was the plant referred to by the ancient Greeks.[4] But the characters of it as given by Theophrastus quite preclude this supposition; and I believe no one has been able to identify satisfactorily the plant described by this ancient naturalist.[5] Dioscorides[6] has noticed two kinds of ἀκόνῖτον.

BOTANY. **Gen. Char.** — *Calyx* petaloid, irregular, deciduous, or withering; upper sepal concave, helmet-shaped. *Petals* 2, superior (nectaries), on long stalks, expanded at the apex into a bag hidden beneath the helmet (De Cand.).

Sp. Char. —*Flowers* densely spiked or loosely panicled. *Helmet* semicircular, rarely boat-shaped. Bag of the *petals* somewhat conical. *Spur* short, thick, inclined. Wings of the *stamens* cuspidate or evanescent. Lobes of the *leaves* cuneate pinnatisect. *Ovaries* 3, rarely 5, smooth or pilose (De Cand.).

Perennial *herb*. *Root* tapering. *Stem* simple. *Flowers* blue.—This species is subject to great variation in the dense or loose condition of the inflorescence, in the form of the helmet, the colour and size of the flower, the breadth and the number of slashes of the leaves, the downiness of the parts of the plant, and the condition of the stem. De Candolle[7] admits no fewer than twenty-nine varieties.

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[1] Turnbull, *Treat. on Painful and Nerv. Diseases*, p. 78, 1837.

[2] *Hist. Plant.* ix. 16.

[3] *Prod. Fl. Græcæ*, i. 372.

[4] [The derivation is probably ἀ *priv.* and κονιος (dusty), applied by the Greeks to plants growing on barren rocks.—ED.]

[5] Consult J. E. F. Schultze, *Toxicol. Vet.* p. xiii. 1788.

[6] Lib. iv. cap. 77 and 78.

[7] *Prodr.* i. 62.

Hab.—Europe. It is placed among indigenous plants, but it is a doubtful native.

The *Dublin College* directs the root to be used.

The *London College* directs the root (*radix*) as well as the leaves (*folia*) to be employed.

The *Aconitum Napellus* is one of the most active species of the genus, and no good evidence has yet been adduced to prove its inferiority to the *A. paniculatum var.* γ *Storkianum*, which Stork published as *A. Napellus officinalis*, and which was formerly adopted as the officinal plant.

Moreover, the roots of *A. paniculatum* are not found in commerce, nor is the plant grown (except in botanical gardens) in this country; so that druggists and apothecaries could not if they would have obeyed the former directions of the London and Dublin Colleges.

DESCRIPTION.—Aconite root (*radix aconiti*), when fresh, consists of a short rapidly tapering rootstock, placed perpendicularly, or nearly so, in the earth, and of numerous cylindrical fleshy fibres arising from it. At its upper and thickest part the rootstock seldom exceeds the thickness of the finger; inferiorly it is attenuated and filiform. Sometimes two or three rootstocks are conjoined. In the latter case the root has a palmated appearance. Its total length is three or four or more inches. Its colour, as well as that of the fibres, is externally coffee-brown; its odour is earthy. Internally it is white and fleshy. Its taste is bitter; but after a few minutes a remarkable numbness and tingling is perceived on the lips, tongue, and fauces. By drying, the root shrivels, and becomes darker coloured. The root should be gathered in the spring, just before the leaves appear. The *leaves* (*folia aconiti*), when chewed, have the same taste, and produce the same feeling of numbness.

COMPOSITION.—No complete analysis either of the root or the leaves of *Aconitum Napellus* has been made. The following are the constituents of the root of *A. Lycoctonum*, according to Pallas:[1] *a black oil, a green fatty matter, a substance having some analogy with the vegetable alkalies* [impure aconitina?], *vegetable albumen, starch, lignin,* and some *salts.*

The leaves of *Aconitum medium Schraderi* were analysed by Bucholz.[2]

Both Brandes and Peschier announced the existence of a peculiar alkali (*aconitina*) in aconite. Their statement was confirmed, in 1825, by Pallas,[3] and, in 1832, by Geiger and Hesse.[4] Peschier also asserted that aconite contained a peculiar acid (*aconitic acid*). His assertion has been substantiated by L. A. Buchner, Jun.[5] It has been since ascertained that the same acid is developed by the action of heat on citric acid. Most chemists have admitted the existence of *a volatile acrid principle* in aconite, but it has not hitherto been isolated.

1. ACONITINA.—See *post*, p. 694.

2. VOLATILE ACRID PRINCIPLE.—This principle, though admitted by several chemists, has not been isolated. Geiger[6] submitted the fresh herb of Aconitum Napellus, with water, to distillation, and obtained a liquor having an acrid taste, an unpleasant odour, and whose emanations affected the eyes. May not this volatile principle be the product of the decomposition of aconitina? The following circumstances favour this suggestion:—1st. The fresh herb and root have little odour; 2ndly, the local effect of aconitina is similar to that of the root and leaves; 3rdly, aconitina, when mixed with

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[1] *Journ. de Chim. Méd.* i. 192.

[2] Gmelin, *Handb. d. Chem.* ii. 1241.

[3] *Op. supra cit.*

[4] *Journ. de Chim. Méd.* x. 464.

[5] *Pharm. Central-Blatt für* 1838, S. 439.

[6] *Ibid.* 1831, 491.

the other constituents of the plant, readily undergoes decomposition, so that considerable nicety of manipulation is required in the extraction of it; and Mr. Morson tells me he has sometimes failed to obtain it.

3. ACONITIC ACID.—In the evaporation of the juice of aconite, octahedral crystals of *aconitate of lime* are frequently deposited. From these L. A. Buchner obtained the acid. The acid also exists in *Equisetum fluviatile*, and may be formed by the action of heat on citric acid. As obtained from aconite it is scarcely crystalline, merely forming warty elevations. It is white, permanent in the air, odourless, very sour, and is very soluble in water, alcohol, and ether. When heated it fuses, and at the same time undergoes decomposition; but does not yield fumaric acid. From the latter acid it is distinguished by its greater fusibility and solubility; from maleic acid by its forming indistinct crystals, and not yielding fumaric acid by heat. The anhydrous acid, as found in aconitate of silver, consists of $C^4H^1O^3$.

4. FATTY OIL.—This is extracted from the root by alcohol. It is dark-coloured. All the specimens of it which I have obtained possess a powerfully benumbing property [from the presence of aconitina?].

[The active principles of aconite are diffused through the whole of the plant, but the root, whether young or old, contains these principles in the greatest quantity,—then the plant itself before flowering; and lastly, the seeds, which are the least active. The wild plant contains more of these active principles than that which is cultivated. The plant has greater activity just before flowering than at a later period, but even at this time the root has six times the activity of the plant itself. If carefully dried and kept in a dry place the leaves retain their colour and the active principle. The alcoholic, has a power four times as great as the aqueous extract.[1]—ED.]

PHYSIOLOGICAL EFFECTS.—Hitherto I have met with no clear and accurate account of the effects of aconite, and some of them appear to me to have been entirely overlooked.

a. On Animals.—If a small quantity of the soft alcoholic extract of the root of aconite be introduced into a wound (as into the cavity of the peritoneum) in a dog, it usually causes vomiting (sometimes of a stercoraceous character), diminishes the force of the circulation, weakens the muscular system so as sometimes to cause the animal to stagger in walking, and destroys common sensibility of feeling, without causing stupor. A dog under the influence of not too strong a dose will sometimes follow its owner round the room, recognise him by wagging his tail when called, and yet be totally insensible to pinching, pricking with needles, &c. Convulsions do not usually occur until a short period before death, and they are then commonly slight, and rather to be termed spasmodic movements. I have repeatedly demonstrated these effects to the pupils attending my lectures.

The following is a notice of one experiment:—

March 31, 1837: London Hospital. Present Mr. Adams, and several medical students.—A small portion of alcoholic extract of aconite was introduced into the peritoneal sac of a strong dog, which had been kept fasting for some hours. In a few minutes he was evidently affected. He was less capable of supporting himself, and leaned against a wall. In ten minutes was insensible to the pain caused by the introduction of pins into his legs, paws, body, tail, nose, &c. His sight, however, was unaffected; at least he winked as usual when attempts to strike him were feigned. Was not paralytic, for he walked, though not firmly. He recognised several individuals, and wagged his tail when spoken to. He made violent attempts to vomit. He then lay down, became apparently weaker, and died without a single convulsion. At one period the action of the heart was slower than usual, and the first and second sounds of the heart were unusually clear and distinct. Subsequently the circulation was quickened. Respiration was not disordered; nor were the bowels affected.

I have subsequently found that if a large quantity of alcoholic extract be used, the loss of feeling is not so well marked; for death succeeds in so short a period of time that the loss of feeling, as distinguished by the insensibility immediately preceding death, is not well observed. For the same reason, rabbits do not answer well for demonstrating these effects; and the weakness (paralysis?) of the hind extremities, and spasmodic movements, are much more marked in them than in dogs. I can distinguish no difference between the effects of Aconitum Napellus on rabbits, and those of Aconitum ferox on the same animals.[1] On opening the bodies of dogs killed by aconite immediately after death, no pulsations of the heart are visible.—Want of space compels me to abstain from entering into any details respecting the experiments made on animals with aconite by Wepfer,[2] Sprœgel,[3] Viborg,[4] Brodie,[5] and Orfila.[6]

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[1] Bouchardat, *Annuaire de Thérapeutique*, 1855, p. 33.

β. *On Man.*—The *topical effects* are peculiar, and most remarkable. If a leaf or a small portion of the root be chewed, or a few drops of the alcoholic tincture of the root be applied to the lips, there are produced in a few minutes numbness and a remarkable tingling sensation. These effects endure for many hours. If the quantity taken into the mouth be somewhat larger, the palate and throat are affected. To me the sensation appears as if the velum and soft palate were elongated, and rested on the dorsum of the tongue. To relieve this, frequent attempts are made to swallow.

When *small and repeated doses* of the *alcoholic tincture* of the root are taken internally, they cause a sensation of heat and tingling in the extremities, and occasionally a slight diuresis.

The *extract of aconite* of the shops is but little to be relied on. Many samples produce neither numbness nor tingling when rubbed on the lips and gums. Störck[7] states that it acts as a diaphoretic and diuretic. These symptoms, however, are by no means constantly produced, and, when they occur, are not always clearly referable to the aconite used.

In *poisonous doses* the effects of aconite are most remarkable. The following details of the effects produced on a family of three persons were furnished me, a few days after the accident, by one of the sufferers (Mrs. Prescott), and her account was confirmed by a very intelligent neighbour who witnessed the progress of the symptoms:—

In December, 1836, Mr. Prescott, aged 57, residing in the City Road, planted in his garden a few pieces of horse-radish. On February 5th, 1837, he observed some green shoots which he supposed to be those of horse-radish. He dug up three of them. The roots (samples of which were given, and have yielded me thriving plants of Aconitum Napellus) were tap-shaped and small. Perhaps a very small walnut would exceed in bulk that of the whole root. These roots were washed, scraped, placed on a plate with some vinegar, and eaten at dinner (at 2 o'clock) with roast-beef, by Prescott, his wife (aged 57), and a child (aged 5). It was remarked at dinner that the root was very mild, and had not the pungency of horse-radish. After the family had dined, about one root was left; so that two had been eaten at dinner, the greater part (perhaps one or one and a half roots) by the husband. About three-quarters of an hour after dinner, Mr. Prescott complained of burning and numbness of the lips, mouth, and throat, and which soon extended to the stomach, and was accompanied with vomiting. The matters ejected were first his dinner, and afterwards a frothy mucus; but at no time was any blood brought up. The vomiting was very violent and constant for an hour, and continued more or less until within half an hour of his death. An emetic was swallowed at a quarter past four o'clock; and therefore the subsequent vomiting may be ascribed, in part at least, to this. His extremities were cold, but his chest was warm: the head was bathed in a cold sweat. His eyes, to use the expression of his neighbour, were "glaring." He complained of violent pain in the head, and trembled excessively. The last symptom might, perhaps, be in part owing to his terror of the mistake he had committed. The lips were blue. His mental faculties were not disordered: on this point I made particular inquiry, and I was assured that he was neither delirious nor sleepy, but was quite conscious until within two minutes of his death. He had no cramp, spasm, or convulsion; the only approach to it was trembling. He frequently put his hand to his throat. Though exceedingly weak he did not lose his power over the voluntary muscles; for within a few minutes of his death he was able, with the assistance of his neighbour, to walk to the water-closet. His bowels were acted on once only after dinner, and that on the occasion just mentioned, which was about an hour after he had taken the emetic and some castor oil. His breathing was apparently unaffected. On his return from the water-closet he was put to bed, and within a few minutes expired, apparently in a fainting state. Death occurred about four hours after dinner.

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[1] See the results of my experiments on the latter plant, in the splendid work of my friend Dr. Wallich, *Plantæ Rariores Asiaticæ*; also a detail of my experiments in the *Edinb. Journ. of Nat. and Geogr. Science*, July 1830, p. 235.

[2] *Hist. Cic. Aq.* 1733.

[3] Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. i. S. 33.

[4] *Ibid.* S. 34.

[5] *Phil. Trans.* for 1811, p. 178.

[6] *Toxicol. Gén.*

[7] *Essay on the Internal Use of the Thorn-Apple, Henbane, and Monkshood*, Lond. 1763.

Mrs. Prescott was affected in a similar way. She had the same burning and numbness of the lips, mouth, throat, and stomach, and violent vomiting. She experienced a curious sensation of numbness in the hands, arms, and legs; and she lost the power of articulating, so that she was unable to tell the address of her son. Her attempts to speak were attended with unintelligible sounds only. She experienced great muscular debility, and was unable to stand. In this respect her condition differed from that of her husband, who could both stand and walk. She felt stiffness of, and difficulty in moving, her limbs. She had no cramps, spasms, or convulsions. The only approach thereto was the stiffness of the muscles when she attempted to put them in action, as in her attempts to wipe her face. Some of the external senses were disordered: thus, to use her own expression, though her eyes were wide open, her sight was very dim, and surrounding objects were seen indistinctly. The hearing was unaffected. The sensibility of the body was greatly impaired; her face and throat were almost insensible to touch. She felt very giddy, but was neither delirious nor sleepy. For the most part she was conscious, but at times scarcely knew what was passing around her. Her body and extremities were cold. She was frequently pulling her throat about, but she knew not why. Five or six hours after dinner she began to recover, and her natural warmth returned. The remedies employed were an emetic, castor oil, pediluvia, rum and water, and some "warm" medicine given her by a neighbouring practitioner. The child was similarly but more slightly affected, except that she evinced a slight tendency to sleep. Like the others she was constantly putting her hands to her throat.[1]

[Since the former edition of this volume appeared, several deaths have occurred from the root of aconite having been eaten by mistake for horse-radish. That such a mistake should be made is an indication of deplorable ignorance, as the roots are widely different in appearance. The aconite root appears to exert its most poisonous action in the winter months when the leaves are absent, and it is chiefly at this period that fatal accidents are likely to occur. In a well-written paper, published in the Pharmaceutical Journal,[2] Mr. Bentley has described the differences, and given accurate figures, of the roots. The distinguishing characters of the roots may be thus described:—

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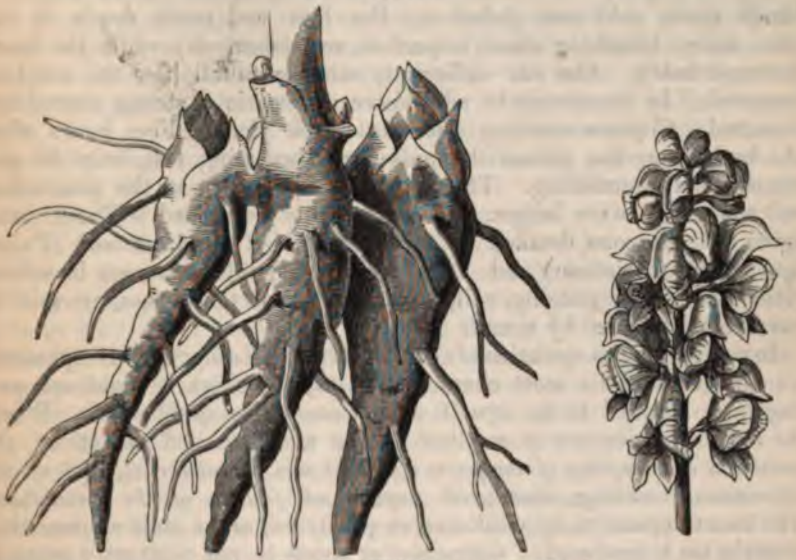
[1] In *The Times* of Nov. 4th, 1842, is a brief report of another case of poisoning by aconite root taken by mistake for horse-radish. The patient was sensible, but died. [Dr. Geoghegan has published some valuable remarks on this form of poisoning in the *Dublin Journal of Medical Science*, vol. xix. page 403.—ED.]

[2] [Vol. xv. p. 450, April, 1856.]

Aconite.	*Horse-radish.*
Form.—Conical in form, and tapering perceptibly (and rapidly) to a point.	*Form.*—Slighty conical at the crown; then cylindrical, or nearly so, and almost of the same thickness for many inches.
Colour.—Externally coffee-coloured, or more or less of an earthy-brown colour.	*Colour.*—Externally white, or with a yellow tinge.
Odour.—Merely earthy.	*Odour.*—Especially developed upon scraping, when it is very pungent and irritating.
Taste.—At first bitter, but afterwards producing a disagreeable tingling and numbness.	*Taste.*—Bitter or sweet, according to circumstances, and very pungent.

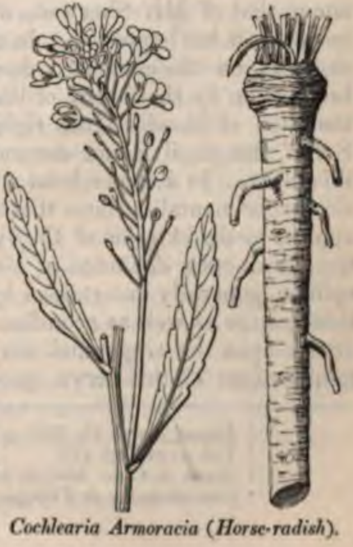
FIG. 110.



Aconitum Napellus (Wolfsbane, or Monkshood).

The brown exterior, the rapid tapering of the root to a point, and the large number of fine fibres proceeding from its sides, are sufficient to distinguish the root of aconite without reference to taste or odour. In November, 1856, one of us was consulted on a case of poisoning by this root, in which a man died in three hours, without stupor or convulsions, as a result of his having swallowed a few slices. Four pieces were found in the stomach unmasticated and undigested. Three gentlemen were poisoned in Scotland in 1855, as a result of their having partaken of aconite root made into sauce by mistake for horse-radish. The root is undoubtedly one of the most fatal of indigenous poisons.—ED.]

FIG. 111.



Cochlearia Armoracia (Horse-radish).

Mr. Sherwen[1] has published a most interesting case of a female poisoned by the alcoholic tincture of the root. About five minutes after swallowing it, she was seized with a pricking and tingling down her arms and fingers, and a painful numbness across the wrists; the tongue and mouth next felt the same, then the legs and feet; and in less than ten minutes her face seemed to her feelings to be swelling, and the throat growing tight. She felt sick, and made many efforts to vomit. Her legs failed, she was almost blind, but was conscious of her condition. When seen by Mr. Sherwen her eyes were fixed and protruded, with *contracted* pupils; countenance livid; jaws and fauces rigid; arms and hands quite cold and pulseless; the legs and trunk much in the same state; breathing short, imperfect, and laborious; while the heart fluttered feebly. She was sufficiently sensible to tell how the accident occurred. In an attempt to administer an emetic a strong convulsion occurred. Copious vomiting afterwards took place. Five hours after she had taken the poison the pulse was becoming full, only 58 per minute, and intermitting. There was less oppression at the præcordia, and the pupils were larger. She eventually recovered. These cases agree with the one detailed in the *Philosophical Transactions.*[2] Pallas (quoted by Christison) and Delgland[3] have published cases in which violent vomiting, purging, colic, and abdominal tenderness, are said to have been produced by aconite [?].

In comparing the operation of aconite with that of other cerebro-spinants, we observe that its most characteristic topical effect is *numbness and tingling.* Applied to the eye it causes *contraction of the pupil.* When the root or its tincture is swallowed, the most marked symptoms are *numbness and tingling of the parts about the mouth and throat, and of the extremities, vomiting, contracted pupil, and failure of the circulation.* The heart appears to be weakened or paralysed, and a state approaching to asphyxia is produced. *Convulsion* or *spasm* is not constantly present, and, when it does take place, is probably a secondary effect arising from the incipient asphyxia. In neither of the cases which I have above detailed, nor in that of Mr. Sherwen, did *stupor* occur. Yet in some recorded instances it has happened. In such it probably depends, as Mr. Sherwen suggests, on the congested condition of the venous system of the brain brought on by the failure of the heart's action, and the consequent accumulation of blood on the right side of the heart. [According to M. Scroff, the pupil is not commonly contracted in cases of poisoning by this plant. In a paper from which we have already made a quotation,[4] this experimentalist states that aconite in general, but especially aconitina, applied to the exterior of the eye, or given internally in sufficient quantity, produces a *dilatation of the pupil,* a result which is opposed to the opinion generally entertained by pharmacologists. Further, he remarks that aconite as well as aconitina appears to have an elective and special action upon the trigeminal nerve. They produce in all the sensorial ramifications of this nerve, peculiar sensations often of a painful kind.

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[1] *Lancet,* March 25, 1837, p. 13.

[2] Vol. xxxviii. p. 287.

[3] *Journ. de Chim. Méd.* iii. 344.

[4] [See *Annuaire de Thérapeutique,* 1855, p. 32. See *post,* page 695.]

Aconite and aconitina produce in man and the rabbit an extraordinary increase in the secretion of urine. Aconite as well as aconitina, exerts a strongly depressive influence on the action of the heart and large vessels. This is observed either immediately, or after a short acceleration of the heart's action. This depressing effect is persistent, and consequently differs from the effects produced by atropia and daturia. These alkaloids, given in a much larger dose than aconitina, cause an acceleration of the pulse beyond the normal condition, although this is preceded by a short interval in which the pulsations are diminished.—ED.]

USES.—A knowledge of the physiological effects of aconite suggests the therapeutical uses of this medicine. A benumber is obviously the physiological remedy for increased sensibility (pain) of the nerves. As a *topical remedy*, aconite is most valuable for the relief of neuralgic and rheumatic pains. In *neuralgia*, no remedy, I believe, will be found equal to it. One application of the tincture produces some amelioration, and, after a few times' use, it frequently happens that the patient is cured. In some cases the benefit seems almost magical. In others, however, the remedy entirely fails to give any permanent relief. Though the pathology of this disease be but little understood, yet we know that the cause of it, and the conditions under which it occurs, are by no means uniform. We are, therefore, easily prepared to believe, that while in some cases aconite may prove beneficial, in others it may be useless. I do not think that in any it proves injurious. The causes of neuralgia are, however, usually obscure, and therefore we are in most cases not able to determine *à priori* the probability or the reverse of the beneficial agency of aconite. Hence its employment must be, for the most part, empirical. I have observed, that when it succeeds, it gives more or less relief at the first application. When the disease depends on inflammation, aconite will be found, I think, an unavailing remedy. In a painful affection of the nerves of the face, arising from inflammation of the socket of a tooth, it gave no relief. In *rheumatic pains*, unaccompanied with local swelling or redness, aconite is frequently of great service. In painful conditions of the intercostal and other respiratory muscles, occurring in rheumatic individuals, I have found this remedy most valuable. In one case of *sciatica* it gave partial relief: but in most cases in which I have tried it, it has failed. In *lumbago* I have not tried it. Dr. Turnbull[1] states that a lady was cured of this disease by the aconite ointment. In *acute rheumatism* its application has not proved successful in my hands; but I have been informed of cases occurring to others in which it has been of great service.

Aconite has been administered *internally* in various diseases, principally on the recommendation of Störck.[2] It has been employed as a narcotic (anodyne) sedative, sudorific, resolvent, and diuretic. The diseases in which it has been employed are *rheumatism*, *gout*, *scrofula*, *phthisis*, *syphilis*, *some skin diseases*, *scirrhus* and *cancer*, *intermittents*, *dropsies*, *paralysis*, *epilepsy*, *amaurosis*, *uterine affections*, and *hypertrophy of the heart*. In the large majority of these maladies scarcely any practitioner now believes in its efficacy. Fouquier gave it very extensive trials without obtaining much relief from it, except as a diuretic in *passive dropsies.* In *rheumatism* it has frequently proved serviceable when combined with a sudorific regimen. I have seen it give great relief in rheumatic pains. In *hypertrophy of the heart* it has been recommended by Dr. Lombard,[1] on account of its decidedly sedative effects.

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[1] See his *Treat. on Painf. and Nerv. Dis.* 1837.

[2] *Essay on the Internal Use of Thorn-Apple and Monkshood*, 1763.

Administration.—The only preparations of aconite, whose activity may be relied on, are the *tincture* of the root (made with rectified spirit), the *alcoholic extract*, and Morson's *aconitina.* The *powder* is given in doses of one or two grains, gradually increased, until some effects are produced; but no reliance can be placed on it. When of good quality, it causes numbness and tingling of the lips and tongue a few minutes after its application to these parts.

Antidotes.—See the treatment for poisoning by tobacco. In Mr. Sherwen's case[2] great benefit was obtained by the abstraction of ten ounces of blood from the jugular vein.

1. TINCTURA ACONITI, L.; *Tinctura Radicis Aconiti*, D.; *Tincture of Monkshood.* (Root of Aconite, recently dried and coarsely powdered, ℥xv.; Rectified Spirit, Oij. Macerate for seven days and strain.) This formula is very nearly that given by Dr. Turnbull.[3] Its dose is five drops three times a day. It should be employed with great caution. As an embrocation in neuralgia and rheumatism, it is invaluable. It is applied by means of a sponge tooth-brush, or a small piece of sponge attached to the end of a stick. Mr. Curtis, of Camden Town, has suggested to me the use of an aconite plaster, prepared by spreading the soft alcoholic extract (obtained by evaporating the tincture) on adhesive plaster, in neuralgia.—[The *Dublin College* gives the following formula for the tincture:—Take of Aconite Root, dried and cut small, ℥x.; Rectified Spirit, Oj. Macerate for fourteen days, strain, express, and filter.

[*Fleming's Tincture of Aconite* is a more powerful preparation. As this has acquired some repute, and has already occasioned several deaths, we subjoin the formula. Take of root of Aconitum Napellus, carefully dried and finely powdered, ℥xvj. troy; Rectified Spirit, f℥xvj. Macerate for four days, then pack into a percolator; add rectified spirit until twenty-four ounces of tincture are obtained. It is beautifully transparent, of the colour of sherry wine, and the taste is slightly bitter. Dose as an anodyne and anti-neuralgic, five minims three times daily. The dose should be cautiously increased.[4] A revenue officer lately lost his life from merely tasting this tincture, under the supposition that it was wine, or a flavoured spirit.—Ed.]

[Mr. Redfern communicated to the author a case of poisoning by tincture of aconite, in which the tincture was probably that which is known as Fleming's tincture. "The patient was a young man of the age of 21, who had been suffering from acute articular rheumatism for some days previous to his admission. He took five drops of the tincture, three time a day, for two days, without marked relief. On the third day this dose was increased to six drops, and was ordered to be taken with the same intervals between the doses as formerly. Unfortunately, however, these directions were not adhered to, for the first dose of six drops was administered at nine o'clock A.M., and the second at eleven. At twelve o'clock, the hour of visit of the physicians, the man was found in a state of extreme restlessness, and complaining of great pain in various parts of his body. To use his own expression, 'he felt as though his skin were too tight for his body.' In imploring relief he described his sensations as most intolerable. At this time there was much frothing at the mouth, with violent retching at intervals. The surface of the body was cold, and bathed in profuse perspiration, which ran down his face in streams. The pulse, though at first 150 in the minute, fell to between 50 and 60 in a few minutes, and was so small and compressible as scarcely to be felt at the wrist. Brandy and water was ordered to be given internally in repeated doses, and warmth was also applied to various parts of the surface. In six hours afterwards the man had almost wholly recovered, and had lost all his rheumatic pains, which never returned. It may be stated that in this case, as well as in three others in which the same tincture was administered, the dose of four or five drops almost invariably produced decided effects, viz. tingling and numbness of the limbs, and very generally relief of the pain."—ED.]

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[1] *Brit. and For. Med. Rev.* i. 249.

[2] *Treat. on Painf. and Nerv. Dis.* p. 91, 1837.

[3] *Lancet*, March 25, 1837.

[4] [*An Inquiry into the Medicinal Properties of the Aconitum Napellus*, by A. Fleming, M.D.]

[2. **TINCTURA ACONITI FOLIORUM**, U. S.; *Tincture of Aconite Leaves.* Take of Aconite Leaves, ℥iv.; Diluted Alcohol, Oij. Macerate for fourteen days; express and filter through paper. This tincture may also be prepared by thoroughly moistening the aconite leaves in powder with diluted alcohol, allowing the mixture to stand for twenty-four hours, then transferring it to a percolator, and gradually pouring upon it diluted alcohol, until two pints of filtered liquor are obtained. This preparation is weaker than the preceding. The dose is gtt. x. to xx.—ED.]

3. **EXTRACTUM ALCOHOLICUM ACONITI**; *Alcoholic Extract of Monkshood.* (Prepared by distilling the spirit from the tincture, until the consistence of an extract has been obtained.)—It has been employed internally in doses of one-sixth of a grain every three hours. It should be given in the form of pills (*pilulæ aconiti*) made of liquorice powder and syrup. It may be also employed externally in the form of ointment (*unguentum aconiti*), composed of one part of the extract, and two parts of lard (Turnbull), or spread on adhesive plaster.

[The U. S. Pharmacopœia gives the following formula. Take of Aconite Leaves, in coarse powder, lb. j.; of Diluted Alcohol, Oix. Macerate the powder with half a pint of diluted alcohol; and having allowed the mixture to stand for twenty-four hours, transfer it to a percolator, and add gradually the remainder of the diluted alcohol. When the last portion of this has penetrated the powder, pour in sufficient water from time to time to keep the mass covered. Cease to filter when the liquor which passes begins to produce a precipitate as it falls in that which has already passed. Distil off the alcohol from the filtered liquor, and evaporate the residue to the proper consistence.—ED.]

4. EXTRACTUM ACONITI, L. E. (Fresh Aconite Leaves, lb. j. Bruise the leaves in a stone mortar; then press out the juice, and evaporate it, unstrained, to a proper consistence, *L.*—"Take of the leaves of monkshood, fresh, any convenient quantity; beat them into a pulp; express the juice; subject the residuum to percolation with rectified spirit, so long as the spirit passes materially coloured; unite the expressed juice and the spirituous infusion; filter; distil off the spirit, and evaporate the residuum in the vapour-bath, taking care to remove the vessel from the heat so soon as the due degree of consistence shall be attained," *E.*)—An uncertain preparation. When of good quality it causes numbness and tingling, within a few minutes after its application, in the mouth and lips. The tincture or alcoholic extract is, in my opinion, greatly to be preferred to this variable preparation.—Dose, one or two grains at the commencement,—to be gradually increased until some obvious effect is produced.

[5. **ACONITINA** ($C_{60}H_{47}NO_{14}$); *Aconitine.* This alkaloid was discovered by Geiger and Hesse in 1833. It is not introduced into any of the British Pharmacopœias. The process for making it as formerly given in the London Pharmacopœia is subjoined with the explanation of the changes by the author.—ED.]

"Root of Aconite, dried and bruised, lb. ij.; Rectified Spirit, *Cong.* iij.; Diluted Sulphuric Acid; Solution of Ammonia; Purified Animal Charcoal, each as much as may be sufficient. Boil the Aconite with a gallon of the Spirit for an hour, in a retort with a receiver adapted to it. Pour off the liquor, and again boil the residue with another gallon of the Spirit and the Spirit recently distilled, and pour off the liquor also. Let the same be done a third time. Then press the Aconite, and, all the liquors being mixed and strained, let the Spirit distil. Evaporate what remains to the proper consistence of an extract. Dissolve this in water, and strain. Evaporate the liquor with a gentle heat, that it may thicken like a syrup. To this add of dilute Sulphuric Acid, mixed with distilled water, as much as may be sufficient to dissolve the Aconitina. Then drop in solution of Ammonia, and dissolve the Aconitina precipitated in diluted Sulphuric Acid and water, mixed as before. Afterwards mix in the Animal Charcoal, frequently shaking them during a quarter of an hour. Lastly, strain, and solution of Ammonia being again dropped in, that the Aconitina may be precipitated, wash and dry it." Aconitina exists in the plant in combination with a vegetable acid (aconitic and probably tannic acid?). Alcohol extracts this salt with some other matters. The alcoholic extract yields this salt to the water, and on the addition of sulphuric acid a sulphate of aconitina is formed, which is decomposed by ammonia, and the aconitina precipitated. It is then again dissolved by sulphuric acid, the solution decolorised by charcoal, and the aconitina again precipitated by ammonia. [Another process consists in decomposing the expressed juice of the leaves of aconite after boiling and filtration by hydrate of lime. Diluted sulphuric acid is added to the filtrate concentrated by evaporation: the sulphate of aconitina thus formed is decomposed by carbonate of potash, and treated by successive quantities of ether until exhausted. The aconitina is obtained by evaporating the ethereal liquid. In order to procure this substance colourless, animal charcoal is required to be used. An alcoholic extract of the root may be treated in a similar manner, or the aconitina may be precipitated from the sulphate formed and may be obtained pure by solution in ether and subsequent decolorisation by animal charcoal. The seeds, as in the case of conium, would probably yield it more readily and in larger proportion.—ED.]

Properties.—As prepared by Mr. Morson, this substance presents the following properties:—It is a nearly white, odourless solid, either dull and amorphous or somewhat sparkling, and apparently crystalline. As it is usually described as being uncrystallisable, I have carefully examined a supposed crystalline mass with the microscope, but I could not detect distinct crystals. The fragments appeared like thin plates of chlorate of potash, and, though they varied greatly in shape, the triangular form seemed predominant. It is strongly alkaline. Heated in a tube, aconitina readily fuses, and forms a pale amber-coloured liquid; and at a higher temperature it is decomposed, without being sublimed: vapours of ammonia only are given off. It is not volatile. [It has no smell, but a bitter followed by a pungent taste; not, however, producing the strong and durable tingling hot sensation perceived when the plant itself is masticated, a fact which has led Geiger to believe that the peculiar taste is derived from some substance like ammonia combined with aconitina in the plant. —ED.] Heated on platinum foil over a spirit-lamp, it burns with a smoky flame and is speedily and entirely dissipated. It is soluble in alcohol, ether, and the acids. From its acid solution it is precipitated by ammonia. A minute portion of it mixed with lard, and applied to the eye, causes *contraction* of the pupil, as I have repeatedly seen. Geiger and Hesse state that the aconitina which they obtained produced *dilatation* of the pupil. Mr. Morson's aconitina is so powerful that one-fiftieth of a grain has endangered the life of an individual. [Judging from its general effects on animals, a dose of one-tenth of a grain would probably destroy life with great rapidity. — ED.] It is the most virulent poison known, not excepting hydrocyanic acid.

[Aconitina is dissolved by concentrated nitric acid without change. Strong sulphuric acid colours it at first yellow and then of a dirty violet red. In reference to solubility, one part of the alkaloid at common temperatures is dissolved by 150 parts of water; but it is soluble in 50 parts of boiling water. A saturated hot solution becomes turbid on cooling. It is more soluble in ether than in alcohol. A diluted solution of it is precipitated by tincture of iodine, tincture of galls, the chlorides of gold and mercury, but not by chloride of platina. Picric acid produces in it a dense yellowish precipitate insoluble in ammonia. Aconitina is completely neutralised by acids forming salts soluble in water and alcohol, but not procurable in a crystalline state. In a dry state they have a gummy consistency, a slightly bitter taste, and present in solution the same reactions as the pure alkaloid. Aconitina is precipitated from them by potash and ammonia, but not by bicarbonate of soda or sesquicarbonate of ammonia. They are poisons of tremendous power.—ED.]

A spurious aconitina is found in the shops. It is imported from France, and bears the stamp and label of a celebrated French chemical firm. Its colour is greyish-yellow. It is inert, or nearly so; at least I have taken one grain of it without perceiving the least effect of it on the tongue or otherwise. It is not completely soluble either in ether or alcohol. When burnt on platinum foil it leaves a calcareous residue. The only genuine aconitina which I have met with is that manufactured by Mr. Morson, of Southampton Row; and Dr. Turnbull informs me that he has found none other to possess any medicinal value. Mr. Skey also found this to be the case.[1]

The *effects* of this alkaloid are similar to those of aconite root, but, of course, much more powerful. If the ointment, or an alcoholic solution of this substance, be rubbed on the skin, it causes intense heat, tingling, and numbness, which continue for more than twelve or eighteen hours. A minute portion of an ointment, composed of a grain of the alkaloid to two drachms of lard, applied to the eye, causes almost insupportable heat and tingling, and contraction of the pupil. This last effect was shown me by Dr. Turnbull, in some amaurotic cases of several years' standing: the pupils underwent no change when the eye was exposed to strong day-light. In very minute doses it has caused heat and tingling upon the surface of the body, and sometimes diuresis; but it cannot be administered internally with safety. In one case, (an elderly lady), one-fiftieth of a grain had nearly proved fatal. Satisfied that great insecurity attends its internal use, Dr. Turnbull tells me he has long since ceased to employ it in this way, as the slightest inattention on the part of the dispenser may be attended with fatal results. The enormous cost (3s. 6d. per grain!) of Morson's aconitina limited its use. I believe that the alcoholic tincture is a perfect substitute for it; and the experience of others confirms my own observation. Of the great efficacy of aconitina in neuralgic and rheumatic affections, no one can entertain any doubt who has submitted the remedy to trial.[1] The following are Dr. Turnbull's formulæ for using aconitina externally:—

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[1] See *Lond. Med. Gaz.* xix. 185.

1. UNGUENTUM ACONITINÆ; *Aconitine Ointment.* (Aconitine, gr. xvj.; Olive Oil, ʒss.; Lard, ℥j. Mix.)—It is employed by friction with the finger during several minutes.

[Dr. Fleming recommends for external use the following preparation:—Take of Aconitina, gr. xvj.; Spir. Rectif. ♏. xvj.; Lard, ℥j. Rub together and make an Ointment.—One or more drachms of the tincture may, according to Dr. Fleming, form an excellent substitute for the ointment in external use; but, when there is any abrasion of the skin the use of any of these preparations is attended with danger.—ED.]

2. *Solutio Aconitinæ; Aconitine Embrocation.* (Aconitine, gr. viij.; Rectified Spirit, ℥ij. Dissolve.)—Used by friction-sponge (as a sponge tooth-brush.) Care must be taken not to employ it where the skin is abraded.

[359. CIMICIFUGA RACEMOSA.—BLACK SNAKEROOT.

Sex. Syst. Polyandria Monogynia.

(Cimicifuga, *U. S.*—The Root.)

BOTANY. **Gen. Char.**—*Sepals* four to five. *Petals* (or rather staminodia) three to five, concave or unguiculate, sometimes by abortion few or none. *Stamens* numerous; *anthers* retrorse. *Style* short; *stigma* simple. *Carpels* one to eight, follicular, many-seeded. Perennial *herbs*. *Leaves* two to three ternately divided, segments incisely serrate. *Flowers* in virgate racemes, white.[2]

Sp. Char.—*Racemes* very long; *leaflets* ovate-oblong, incisely toothed; *staminodia* slender, two-forked.[3] *Root* thick and knotted, with long fibres. *Stem* three to eight feet high, glabrous, furrowed, leafy near the middle. *Leaves* three, ternate; *leaflets* two to three inches long. *Racemes* branching, six to twelve inches long; *pedicels* three to four lines in length, bracteate. *Flowers* very fetid. *Sepals* caducous, greenish-white, concave. *Staminodia* four to eight. *Carpels* globose-ovate, glabrous. *Seeds* seven to eight, compressed and angular. De Candolle states that the flowers are sometimes digynous, but we have never observed more than a single ovary in a flower.[4]

Hab.—This plant is known by the names of *Tall Snakeroot*, *Black Snakeroot*, and *Rich Weed*. Its size, and the long white racemes of flowers make it a conspicuous ornament of the woods.

It is abundant in open woods and on hillsides throughout the United States, from Canada to Florida. It flowers in June and July.

The root as found in the shops is composed of a rough tuberculated head and numerous radicles, seven inches long, of a black colour externally, white internally. The radicles are extremely brittle and liable to be separated. The odour is feeble and earthy; the taste bitter and astringent, leaving an impression of acrimony upon the palate. The sensible properties depend on the time when the root is collected, and the mode of drying and preserving it. It should be collected late in the summer, or in the autumn.

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[1] See Dr. Turnbull, *op. supra cit.*; Mr. Skey, *Lond. Med. Gaz.* vol. xix. p. 181.

[2] Torrey and Gray, *Flor. of North America.*

[3] *Ell.* Sk. ii. p. 16.

[4] Torrey and Gray, *op. cit.* vol. i. p. 36.

COMPOSITION.—An analysis made by Mr. Tilghman, resulted in the detection of the following matters: *Fatty matter*, *gum*, *starch*, *resin*, *tannin*, *wax*, *gallic acid*, *sugar*, *oil*, *black colouring matter*, *green colouring matter*, *lignin*, and *salts of lime*, *iron*, *magnesia*, and *potassa*. The experiments, however, led to no decided conclusion as to the nature of the active principle. "The peculiar bitterness and nauseating properties of the plant seemed more fully developed in the ethereal extract than in any other form."[1]

MEDICINAL PROPERTIES.—Considerable difference of opinion has existed with regard to the influence this medicine is capable of exerting upon the animal economy. The late Professor B. S. Barton considered it to be astringent; he farther informs us that "in a putrid sore throat, which prevailed many years ago in Jersey, a strong decoction of the roots was used with great benefit as a gargle." Dr. Mears, who tried the medicine upon himself, reports a decided impression upon the brain, evinced by a distressing pain in the head and giddiness; it also increased the force and fulness of the pulse, and produced a flushed condition of the face. Uneasiness of the stomach, and violent efforts to vomit were also among the symptoms experienced by him.[2] Dr. Garden had previously mentioned its tendency to affect the brain, which he compared to digitalis; this writer also states that it operates powerfully upon the secreting organs and absorbents, and that, when exhibited in large doses, nausea, vertigo, anxiety, great restlessness, and pains in the extremities were occasioned.[3] Dr. Chapman, speaking of this root, informs us that he has never been able to discover the astringent action in any great degree, but that it is "expectorant, narcotic, antispaşmodic, diaphoretic, and in large doses emetic. Given so as to affect sensibly the system, we find, first, some nausea, followed by greater freedom of expectoration, and more or less relaxation of surface, with slight nervous tremors and vertiginous affection. The pulse during this state is considerably lowered, and is apt to remain so for some time."[4] In addition to these views with regard to the medicine, it may be farther stated that it has been regarded as having a control over the uterus. The diseases to which it has been applied are as diversified as the effects just referred to. Dr. Garden thought highly of it in phthisis pulmonalis, but that the diagnosis was strictly accurate cannot be assumed; the probability is that it proved beneficial rather in similative cases. It is not difficult to understand how service can be obtained in humoral asthma, catarrh, and analogous affections, in which it has been recommended, by a stimulating impression upon the mucous membrane, and the promotion of healthy expectoration. The evidence of a favourable action in rheumatism is of a decided character. In the wards of Professor Dunglison, at the Philadelphia Hospital, it has been used with benefit. He informs us that "when pushed so as to produce catharsis, and even slight narcosis, it certainly appeared to be of service in the acute forms."[1] In the chronic form, we should expect much more to be accomplished by it.

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[1] *Am. Journ. of Pharm.* vol. iv. p. 20.

[2] *Phil. Monthly Journ. of Med. and Surg.* Sept. 1827.

[3] Togno and Durand in *Translation of Manual of Edwards and Vavasseur*, p. 339.

[4] *General Therapeutics.*

In chorea, it is highly spoken of. Several years ago, Dr. Young[2] brought cimicifuga before the profession as a remedy in this disease, and his results have to a certain extent been verified by other physicians. Professor Wood found that a case under his care yielded to it, after the failure of purgatives and metallic tonics. The latter author also exhibited it with benefit in a case of convulsions occurring periodically, and connected with uterine disorder. In these cases, however, its precise mode of operation is obscure.[3]

DOSE.—Black snakeroot may be given in *powder*, in doses of half a drachm, two or three times daily.

The *decoction* is made by boiling for a few minutes ℥j. of the contused root in Oj. of water. The dose is ℥j. or ℥ij.. two or three times daily. This is a better form than the powder.

The *tincture* may be made with ℥iv. of the bruised root, and Oj. of Diluted Alcohol. The dose is gtt. xx. to fʒj., two or three times daily. This preparation is adapted to rheumatic cases.—ED.]

[360. COPTIS TRIFOLIATA, *Salsb.*—GOLDEN THREAD.

Sex. Syst. Polyandria Polygynia.

(Coptis, *U. S.*—The Root.)

BOTANY. **Gen. Char.**—*Sepals* 5 to 6, petaloid, deciduous. *Petals* 5 to 6. *Stamens* 15 to 25. *Follicles* 5 to 10, on long stipes, somewhat stellately diverging, membranaceous, ovate oblong, pointed with the style, 4- to 8-seeded. *Herbs* with radical, divided, subcoriaceous leaves, and very slender, extensively creeping roots.

Sp. Char.—*Leaves* 3-foliate; *leaflets* cuneiform-obovate, crenately and mucronately toothed, obscurely 3-lobed; *scape* 1-flowered. *Roots* consisting of long bright yellow fibres, intensely bitter. *Leaves* evergreen; *leaflets* about an inch long. *Scape* slender, three to five inches high. *Sepals* 5 to 7, oblong, obtuse, white. *Petals* much shorter than the sepals, yellow at base. *Carpels* acuminated with the persistent style. *Seeds* oblong, black, and shining; *raphe* very indistinct.[4]

Hab.—This plant is found in mountain bogs, from Greenland and Labrador to Pennsylvania.

The root, which is the officinal portion, is brought into the market in the dried state. It is filamentous, threadlike, and of a deep golden-yellow colour, very brittle. The fibres are usually commingled with the leaves of the plant. By the Shakers, the whole plant appears to be compressed into the square form. It has no odour; the taste is bitter without astringency.

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[1] *General Therapeutics and Mat. Med.* vol. ii. p. 194.

[2] *American Journ. of Med. Science*, vol. ix.

[3] [See *Trans. Amer. Med. Assoc.* 1847, vol. ii. p. 686.—ED.]

[4] Torrey and Gray, *Flor. of North Amer.* i. 28.

USES.—This article of the Materia Medica is ranked among the pure bitters, as its medicinal properties appear solely to depend upon a bitter extractive matter. It may be employed as a tonic under circumstances calling for the exhibition of such remedies, and may be ranked with *sabattia* and that class of articles, acting as a stomachic, improving the appetite, &c. It is not so powerful as gentian, quassia, and other pure bitters. In the treatment of aphthous sore mouths of children, it has been used as an application in New England.

DOSE.—The mode of employment may be in the form of *infusion*, which may be made in the proportion of ℥ss. to Oj. of Water.—Dose, ℥j. to ℥ij.

A *tincture* is made by macerating ℥j. of the Root in Oj. of Alcohol. —Dose, fʒj. to fʒij.

The dose of the *powder* is gr. xx. to ʒj. An extract might be prepared.—ED.]

[361. COPTIS TEETA, *Wallich.*—MISHMEE BITTER.

AMONG the numerous and interesting drugs exhibited in the India department of the Great Exhibition, was a root marked "*Mishmee Bitter*," or "*Mishmee Teeta*," the produce of a ranunculaceous plant, called, by my friend Dr. Wallich,[1] *Coptis Teeta.* I have also recently received the same root in a collection of the Materia Medica made in Scinde by Dr. Stock, who says that the root is called "*Mahmira*," and is used in inflammation of the eyes. It is probable, however, that the word "Mamiran" or "Mahmira" is used in the East generically, and that the *Coptis Teeta* is one out of several species of it. The root of *Coptis Teeta* has been long known in Europe under another name, and some of the latest European writers on Pharmacology appear to be quite unacquainted with its real origin.

The first accurate notice of this root is that given by Dr. Wallich, whose account I subjoin:—

"*Mishme Teeta* is the name by which the drug is designated among the Mishmees and Lamas, in the mountainous regions bordering upon Upper Assam. The Chinese call it *Honglane.* Among these three nations it is in great estimation, and in universal use as a powerful tonic and stomachic. Quantities are sent down to Assam in neat little baskets, with open meshes, made of narrow slips of ratan, or some such material, and measuring three to four inches in length by two and a half in breadth and one and a half in width. Each basket contains about an ounce of small pieces of the root, from one to three inches long; they are nearly cylindric, uneven, scabrous, more or less curved, of a greyish brown colour, and varying in thickness from the size of a crow-quill to double that diameter. The root is perfectly dry and brittle; occasionally a few fibrillæ are issuing from one end; the inside is hard, somewhat cellular, the outside of a dingy yellow colour. The taste is intensely and purely bitter, very lasting, and with only a very slight aroma. On mastication, the root tinges the saliva yellow; its interior is bright yellow or gold-coloured. It possesses no smell whatever." Subsequently he obtained some fresh roots, with leaves, and incomplete specimens of the inflorescence. From these materials he drew up a botanical description of the plant, from which I extract the following specific characters:—"*Coptis Teeta*, foliis trisectis, segmentis petiolatis, lobato-pinnatifidis, lobis incisis acutissime setaceo-serratis; scapo paucifloro bracteis foliaceis lineari-tripartitis."

The root, as shown by the East India Company at the Great Exhibition, corresponded entirely with Dr. Wallich's description, and was contained in the same little baskets in which he describes it as being sent down from Assam.

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[1] *Notes on the Drugs called Mishmee Teeta and Pucha Pat*, by N. Wallich, M.D. In the *Transactions of the Medical and Physical Society of Calcutta*, vol. viii. part 1, page 85. Calcutta, 1836.

No chemical examination has yet been made of this root. Mr. Twining,[1] who subjected it to a few experiments, says that, "Judging from the taste, it does not possess much astringency; and this opinion is confirmed by finding that neither the tincture nor the infusion is much affected by the solution of sulphate of iron. 280 grains of the root, when coarsely powdered, and macerated in proof spirit for five days, were found to have lost 180 grains. The residue of the above tincture, when dried, amounting to 300 grains, was macerated for 30 hours in distilled water, and only 26 grains were found soluble in water; as the residuum, when dried, weighed 174 grains." The root appears to abound in a yellow bitter principle, soluble in alcohol and water.

The *medicinal properties* of this root are those of a bitter tonic. It aids in the restoration of the appetite and the promotion of the digestive powers in patients recovering from acute maladies. It may be given in powder, infusion, tincture, and extract. The dose of the powder is from five to ten grains thrice daily.[2]—ED.]

OTHER MEDICINAL OR POISONOUS RANUNCULACEÆ.

1. The leaves of HELLEBORUS FŒTIDUS are emetic and purgative. They have been employed as a vermifuge against the large round worm (*Ascaris lumbricoides*).

2. HELLEBORUS VIRIDIS possesses similar properties.

3. ACONITUM FEROX is, perhaps, the most violent of the ranunculaceous poisons. It is a Nepal plant, and constitutes the *Bish* or *Bikh* poison of that country. Several years since I undertook, at the request of Dr. Wallich, to examine the effects of this plant on animals. My experiments were made with plants which had been ten years in Dr. Wallich's possession, and which, therefore, had doubtless lost part of their activity; yet their effects were most energetic;[3] but of the same nature as those of Aconitum Napellus.

[ORDER LXXXVIII. MYRICACEÆ GALEWORTS.—*Lind.*

This order includes leafy shrubs or small trees covered with resinous glands and dots. They are found in the temperate parts of North America, the tropical districts of South America, the Cape of Good Hope, and India. One species inhabits the swamps of Europe. The only plant of this order which here requires a brief notice is the *Myrica Cerifera*, the chief source of the product known under the name of *Vegetable Wax*.]

[362. MYRICA CERIFERA.

HISTORY.—This plant is commonly known under the name of wax myrtle or candleberry myrtle, owing to the quantity of wax which is obtained from its berries.

BOTANY.—The genus myrica ranks in the natural arrangement of plants in the order *Amentaceæ* and in the suborder *Myraceæ*.

Gen. Char.—*Flowers* unisexual, monœcious or diœcious, arranged in catkins. *Scales* of the catkin single flowered, concave; *stamens* 4; *styles* 2, filiform; *drupe* one-celled, one-seeded, covered by waxy scales.

Hab.—The United States. It abounds in Louisiana, New Brunswick, and other parts of North America. It is also found in the Bahama Islands, and in the Cape Colony.

VEGETABLE WAX, *Extraction.*—Although the wax obtained from the berries of this plant has been long known in this country, it has not been brought into general use and is comparatively but little known to pharmaceutists. It has been suggested that it may be employed as a substitute for animal wax in the arts and manufactures.

We are indebted to Mr. Simmonds for the most recent information which we possess on the cultivation of the plant and the extraction of the wax.[1] This information is derived chiefly from the researches of Mr. Feeney and Mr. Bowie of Cape Town.

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[1] [In a note appended to Dr. Wallich's paper.]

[2] [From a paper by the late Dr. Pereira, *Pharmaceutical Journal*, January 1852.—ED.]

[3] Wallich's *Plantæ Asiaticæ rariores*; and the *Edinb. Journ. of Nat. and Geogr. Science*, July, 1830, p. 235.

The myrtle shrub or bush produces a small green berry of the size of a pea covered with a blueish powder. The wax is extracted from the berries by placing them in a pot of boiling water. In a few minutes the wax floats to the top in a melted state and it is then skimmed off, the berries being stirred gently with a ladle during this time. The skimming must be performed rapidly in order to prevent the wax from being coloured by the pulp. The skimmed wax in a melted state undergoes two strainings through flannel in order to separate impurities. The wax being the produce of the pulp, this will retain more or less until the berries are quite ripe. The plant has not been found to bear under the fourth year in any situation.

A prize medal was awarded at the Great Exhibition of 1851 for some specimens of this wax forwarded from the Cape Colony, and a consignment of 2561 pounds of this wax was imported from the colony in 1852. This, after payment of all expenses, netted clear about £54.

PROPERTIES.—Myrtle wax differs from bees-wax in physical and chemical properties. When fresh it is of a yellowish green colour, and is said to emit a balsamic odour. It has the rough, mealy fracture of wax. It cannot be easily bleached like bees-wax, and its specific gravity is greater, since it sucks in water. By saponification it yields stearic, margaric, and oleic acids with glycerine: hence it is rather of the nature of fat than wax.[2]

The formula of this wax is $C^{36}H^{36}O^{5}$.

Japan or Tree Wax.—$C^{36}H^{36}O^{2}$. This is said to be derived from the fruit of *Rhus Succedanea*, which is stated to be one of the trees on which the wax insect of China (*Coccus Sinensis*) feeds. The substance has the appearance of wax, but is a fat identical, according to Sthamer, with *Palmitine*, the solid part of palm oil. It contains no oleine and is easily saponified. Heated with nitric acid, Japan wax yields succinic acid. Mr. Hanbury states that eighty cases of this article were offered for sale in 1852, as Japan bees-wax. It was in circular cakes of about four inches in diameter, one inch thick, flat on one side and rounded on the other as if cast in a saucer. The melting points of two samples he found to be 125° to 131° respectively.[3] Substances resembling wax are obtained from Croton sehiferum, Celastrus ceriferus, and Ceroxylon audicola.

Cerosine ($C^{48}H^{50}O^{2}$ Dumas).—Some species of sugar-cane yield a wax-like substance on the surface, to which this name has been given. It forms light pearly scales fusible at 180°, and is not saponified by potash.[4]—ED.]

[ORDER LXXXIX. PODOPHYLLEÆ, *Lind.*

ESSENTIAL CHARACTER.—*Sepals* 3 to 4, deciduous or persistent. *Petals* in 2, 3, or more rows, each of which is equal in number to the sepals. *Stamens* hypogynous, 12 to 18, arranged in two, three, or more rows; *anthers* linear, oval, turned inwards. *Stigma* somewhat peltate. *Fruit* succulent or capsular, 1-celled. *Seeds* indefinite; *embryo* small.

Herbs.—*Leaves* broad-lobed. *Flowers* radical, solitary, white (Beck).

[363. PODOPHYLLUM PELTATUM, *Linn.*—MAY-APPLE.

Sex. Syst. Polyandria Monogynia.

(Podophyllum, *U. S.*—The Root.)

BOTANY. **Gen. Char.**—*Sepals* 3. *Petals* 6 to 9. *Stamens* 12 to 18. *Stigma* large, subsessile, peltate. *Berry* somewhat fleshy, not dehiscent. *Seeds* many.

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[1] See *Pharmaceutical Journal*, vol. xiii. p. 418.

[2] Turner's *Chemistry*, by Liebig and Gregory, vol. ii. p. 1127.

[3] *Pharmaceutical Journal*, vol. xii. p. 476.

[4] Turner's *Chemistry*, vol. ii. p. 1127.

[5] *Ibid.*

Sp. Char.—*Stem* erect, 2-leaved, 1-flowered; *fruit* ovate.

The common names by which this plant are known are *May-Apple* and *Hog-Apple*. It has a large, horizontal, creeping perennial root; the stem is from eight to twelve inches high, naked, with sheathing stipules at the base, dichotomous at the summit, dividing into two petioles two to four inches in length, each bearing a peltate leaf. The leaf is large, hanging, divided into five to seven lobes, cuneate, oblong, dentate, and often bifid at the apex. Flower solitary in the axil of the petioles; peduncle recurved, white. The fruit is an oval berry, an inch and a half long, smooth, yellowish when mature, succulent, and pulpy, having a mawkish sweet taste, edible, but not agreeable.

Hab.—May-Apple is common throughout the United States, in moist woods and shady situations along the banks of rivulets. It flowers in May.

In the dried state, the root is found in pieces several inches in length, the thickness of quills; some of them are knotty and swollen at intervals (jointed), and beset with the remains of the radicles, somewhat corrugated and wrinkled; externally the colour is deep brown or blackish; internally dingy white. The fracture is short. The entire root has little odour; the taste is sweetish, bitter, and somewhat acrid.

The powder is greyish; it has somewhat the odour of ipecacuanha.

CHEMICAL COMPOSITION.—Podophyllum has been examined with the view to determine its constituents. Dr. E. Staples found it to contain resin, starch, and a peculiar vegetable substance crystallisable in white silky tufts.[1] Mr. Hodgson obtained from it also a peculiar principle. To this the name *Podophylline* has been given.

PODOPHYLLINE. (Hodgson.)—When dry, this substance is in pale brown scales of considerable lustre; is easily pulverised, is unalterable in the air, and has a strong bitter taste. It is copiously soluble in strong alcohol, and much more so in boiling than in cold water, the aqueous solution retaining when cold about a grain to the ounce. It is soluble to some extent in sulphuric ether. It is readily separated from water by muriatic acid, is coloured red by nitric acid, and becomes first olive or green, and subsequently purple by sulphuric acid. Exposed to heat it fuses, blackens, and is dissipated in black smoke.[2] It has not as yet been determined whether this or the resin is the active principle.

MEDICINAL PROPERTIES.—May-Apple root is an active cathartic, resembling jalap in its action upon the bowels. It stimulates the muciferous glands and exhalants, and occasions watery discharges; in too large quantities, giving rise to tormina. It is highly spoken of by many eminent writers, who have tested its efficacy. Dr. Eberle[3] says he very frequently gave it instead of jalap, and always found it active and safe in its operation. Dr. Burgon regarded it as slower in its operation than jalap, but as leaving the bowels longer in a lax condition.[4] The cases to which it is adapted are of an inflammatory character, especially at the commencement, where brisk purging is required. In bilious fevers, and intermittents, it has been much used throughout the United States. Combination with calomel or cream of tartar increases the certainty of its action, and at the same time moderates its drastic effects. In over-doses, it occasions tormina and tenesmus, and hypercatharsis with mucous and bloody discharges; it also nauseates the stomach and induces vomiting.

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[1] Togno and Durand, *Translation of Edwards and Vavasseur's Manual.*

[2] *Journ. of Phil. Col. of Pharm.* vol. iii. 275.

[3] *Mat. Med.*

[4] *Med. Recorder*, iii. 332.

The leaves of the plant and young shoots are said to be highly poisonous.

The dose of the powdered root is from ten to twenty grains.

EXTRACTUM PODOPHYLLI, U. S. This preparation is made in the same way as the Extract of Jalap. It has the advantage over the crude medicine of being given in smaller bulk, and may be substituted for it, or for the extract of Jalap.—Dose, ten to fifteen grs.—ED.]

[ORDER XC. JUGLANDEÆ, *De Cand.*, *Lind.*

ESSENTIAL CHARACTER.—*Flowers* diclinous. *Sterile flowers* in an ament. *Perianth* scaly, oblique, irregularly lobed. *Stamens* inserted on the receptacle, indefinite (three to thirty-six); *filaments* short, distinct; *anthers* thick, two-celled, bursting longitudinally. *Fertile Flowers* with a single or double perianth, the outer four-parted, the inner (when present) of four pieces. *Ovary* inferior, one-celled; *ovule* solitary, erect; *styles* one to two, very short or none; *stigmas* large, either two and lacerated or discoid and four-lobed. *Fruit* drupaceous, one-celled, with four imperfect partitions. *Seed* four-lobed; *embryo* large; *albumen* none; *cotyledons* fleshy, two-lobed, wrinkled; *radicle* superior.

Trees.—*Leaves* alternate, unequally pinnate (Beck).

[364. JUGLANS CINEREA, *Linn.*—BUTTERNUT.

Sex. Syst. Monœcia Polyandria.

(Juglans, *U. S.*—The inner Bark of the Root.)

BOTANY. **Gen. Char.**—Monœcious. *Sterile flowers*; ament imbricate, scales mostly 5-parted. *Perianth* 5- to 6-parted. *Stamens* 18 to 36. *Fertile flowers; perianth* double, each 4-parted. *Styles* 1 or 2. *Drupe* partly spongy; *nut* rugose and irregularly furrowed.

Sp. Char.—*Leaves* pinnate; *leaflets* numerous, lanceolate, serrate, rounded at the base, soft, pubescent beneath; *petioles* villous; *fruit* oblong ovate, with a terminal projection, viscid and hairy, on a long peduncle; not oblong, acuminate, conspicuously sculptured.

This plant is the *J. cathartica* of Michaux. The common names by which it is known in the United States are *White Walnut* and *Butternut*. In some situations it is a large tree, with numerous branches and a smooth cinereous bark. The fruit is less rank and strong than the black walnut, but by age becomes rancid and unpleasant; it abounds in oil. Early in the spring, if the bark be pierced, there exudes a saccharine juice.

Hab.—Butternut abounds in Canada and the northern and middle sections of the United States, in rich bottom lands and along streams. It flowers in May, and the fruit ripens in September and October.

The inner bark, when first separated from the tree, is of a pure white colour, but soon begins to change, and by the time it becomes dry, is of a deep brown colour. It comes into the market in pieces, which have a

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[1] Beck, *Botany of North. and Mid. States*, 335.

fibrous fracture. If the epidermis has not been removed, they are smooth externally. The inner bark is the officinal portion; that from the root is most active. When in the fresh state a rubefacient effect is stated to be made upon the skin. The period for collecting it is in May. The odour is feeble, and the taste is bitter and pungent.

COMPOSITION.—Mr. S. Wetherill found in this bark *fixed oil*, *resin*, *saccharine matter*, *lime*, and *potassa*, *a peculiar principle* (*extractive?*), and *tannin*.[1] Dr. Bigelow did not find tannin by the action of gelatine. Mr. Wetherill, however, found a precipitate afforded by standing.

EXTRACTUM JUGLANDIS, U. S. *Extract of Butternut.*—This is the officinal preparation, which is mostly used. It is made by displacement from the bark, in coarse powder, by means of water, and evaporating the solution. It is of a black colour, having a caramel-like odour, and bitter astringent taste. It is a mild cathartic, operating without pain or irritation, and evacuating the alimentary canal without depletion. For a long time it has been employed as a purgative throughout the United States, and is one of the articles to which Dr. Rush directed attention. Dr. Barton, in his *Collections*, also speaks highly of it. By all the subsequent writers upon Materia Medica, it is noticed as one of the most valuable of the indigenous productions of America. The cases to which it is adapted are, fevers, with disturbance of the liver and congestion of the abdominal organs, habitual costiveness, and dysenteric affections. By combination with a mercurial, as blue pill or calomel, its powers are increased. The dose is 10 to 30 grains, in pill. The extract which is brought in from the country, and made by decoction, is objectionable, from the little care taken in its preparation.

A decoction is sometimes used, but the taste and the quantity required render it inferior to the officinal preparation.—ED.]

[ORDER XCI. GERANIACEÆ, *De Cand.*, *Linn.*

ESSENTIAL CHARACTER.—*Sepals* five, persistent, more or less unequal, with an imbricate æstivation; sometimes saccate or spurred at the base. *Petals* five (or by abortion four, rarely none), unguiculate. *Stamens* usually monadelphous, hypogynous, twice or thrice as many as the petals. *Ovary* composed of five pieces, placed round an elevated axis, each one-celled, one-seeded; *ovules* pendulous; *styles* five, cohering round the axis. *Fruit* formed of five carpels cohering round the axis, having a membranous pericarp and terminated by an indurated style, which finally twists and carries the pericarp along with it. *Seeds* solitary, pendulous; *albumen* none. *Embryo* curved; *radicle* pointing to the base of the cell; *cotyledons* foliaceous, convolute, and plaited.

Herbs or *shrubs*.—*Stems* tumid and separate at the joints. *Leaves* either opposite or alternate (Beck).

[365. GERANIUM MACULATUM, *Linn.*—SPOTTED GERANIUM.

Sex. Syst. Monadelphia Decandria.

(Geranium, *U. S.*—The Root.)

BOTANY. **Gen. Char.**—*Sepals* 5, unequal. *Petals* 5, equal. *Stamens* alternate, fertile ones larger, and with nectariferous scales at the base.

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[1] *Unpublished Essay.*

Carpels with long awns, at length separating elastically from the summit to the base; awns smooth internally (Beck).

Sp. Char.—*Root* perennial, irregularly gibbous and horizontal, brownish, mottled with green externally, and greenish-white internally. From the root spring a number of radicle leaves and one or more stems: these are erect and terete, of a green colour, and furnished with reflexed hairs. At the height of six, eight, or ten inches from the ground, the stem becomes forked; and at the point of division is furnished with two large petiolate leaves, which are generally reflexed. *Leaves* on the upper part of the stem either with very short petioles or sessile. The peduncles arise from the dichotomous divisions of the stem, and support two flowers on short pedicles. The calyx consists of five oval, lanceolate, ribbed, cuspidate segments, plumosely ciliate at their outer margin, and membranous on the other; sometimes three of the segments only are ciliate. *Petals* 5, obovate not emarginate. *Stamens* 10, furnished at the base with glands, and terminated by oblong, convex, deciduous anthers of a purple colour. *Germ* ovate. *Style* persistent, the length of the stamens at first, but afterwards elongated. *Stigmas* 5. *Capsule* containing five seeds, which, when mature, becomes detached by the elasticity of the awns.[1]

The common names for this plant are *Crowfoot* and *Crane's bill.* It is a handsome plant, of which there are several varieties, varying in the form of the foliage and colour of the flower; these depend upon soil and situation. The most usual colour of the flower is lilac.

Hab.—The geranium maculatum is a common plant, growing in hedges and the borders of damp woods. It flowers in May.

In the dried state, the root presents itself in pieces an inch or two in length, and three to four lines thick, corrugated, wrinkled, and rough, with a few fibres attached; externally the colour is brown, internally dingy white. It breaks with a short fracture. The odour is feeble, the taste astringent and bitter. The powder is grey.

CHEMICAL COMPOSITION.—From Dr. Staples's analysis, it appears that Geranium contains *gallic acid* in large quantity, *tannin, mucilage* in a small proportion, *amadin* (?), *red colouring matter*, principally in the external covering of the root, *resin* in small quantity, and a crystallisable vegetable substance.[2]

MEDICINAL PROPERTIES.—Geranium is an astringent of some power, and the therapeutical uses to which it has been put, are based upon this action. It early attracted the attention of those who were inquiring into the remedial value of indigenous plants, and has been uniformly spoken of by all subsequent writers upon the same subject. In its effects and range of application it differs not from others of the same class; more powerful than some, less so than others. In hemorrhages and bowel affections, under the appropriate pathological conditions calling for their exhibition, geranium may be administered with advantage. As a local application in chronic inflammation, ulceration, &c., benefit may equally be expected from it, as for instance in the form of a gargle where the throat is involved, and in that of injection in gonorrhœa and leucorrhœa. The forms of exhibition are varied.

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[1] Griffith, *Am. Journ. of Pharm.* vol. iv. p. 90.

[2] *Journ. of Phil. Col. Pharm.* i. 171.

If the powder be used, the dose is from 10 to 30 grains. The *decoction* is made by boiling an ounce of the bruised root for a few minutes in a pint of water. Dose, f℥j. to f℥ij. An *infusion* may be prepared in the same manner. A *tincture* and an *extract* are prepared from it.—ED.]

[ORDER XCII. CORNACEÆ, *De Cand.*—THE DOGWOOD TRIBE.

ESSENTIAL CHARACTER.—*Calyx* adherent to the ovary; *limb* four to five toothed, minute or four to five-lobed, with a valvate æstivation. *Petals* distinct, equal in number to the teeth of the calyx, and inserted alternately with them into the margin of the hypogynous disk, broad at the base; *æstivation* valvate. *Stamens* four to five, inserted with the petals, and alternate with them; *anthers* introrse, mostly cordate. *Ovary* one-celled, with solitary pendulous ovule in each cell; *styles* single. *Drupes* baccate with a one to two-celled nucleus, crowned with the remains of the calyx. *Seeds* anatropous. *Embryo* nearly the length of the fleshy albumen; the radicle shorter than the oblong cotyledons.

Trees or *shrubs*, rarely herbaceous, with a bitter bark. *Leaves* opposite (or rarely somewhat alternate), mostly entire, exstipulate, pinnately veined. *Flowers* cymose; the inflorescence sometimes capitate and involucrate, rarely diœcious. *Hairs* centrally affixed.[1]

366. CORNUS FLORIDA, *Linn.*—DOGWOOD.

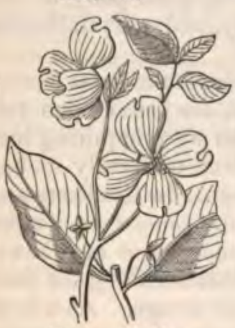
Sex. Syst. Pentandria Monogynia.

(Cornus Florida, *U. S.*—The Bark.)

BOTANY. **Gen. Char.**—Limb of the *calyx* 4-toothed, minute. *Petals* oblong, spreading. *Filaments* filiform. *Style* subclavate; *stigma* obtuse or capitate. *Drupes* not connate into a syncarpium. *Leaves* entire, minutely scabrous, with the appressed bicuspidate hairs. *Flowers* white, rarely yellow.[2]

Sp. Char.—*Leaves* of tne involucre four, obcordate, or with a callous notch at the apex; *drupes* oval; *leaves* ovate acuminate.

FIG. 112.



Cornus Florida.

Dogwood is a small tree, varying in height from 15 to 20 or 30 feet, rarely attaining more, with an irregular growth. The branches are numerous and expanded. It is a conspicuous ornament of the forest in the spring of the year, when the large leafy involucres are expanded and resemble showy white flowers diffused in every direction. Within the involucres are the flowers, in clusters, rather inconspicuous, greenish-yellow. The leaves are developed after the flowers. In the fall of the year they become deep red. The drupe or berry is bright red when mature.

Hab.—This plant is common throughout the United States, growing in open woods in moist soil from Canada to Florida and Louisiana. Its growth is modified by the climate; to the south it attains its extreme size. In the northern sections of the country the time of flowering is May, but in the southern it is during March and April.

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[1] Torrey and Gray.
[2] Ibid.

The bark of the tree constitutes the officinal portion of the U. S. Ph.; that from the root is regarded as most efficacious. It is brought into the market in pieces slightly quilled, several inches long, half an inch to two broad, and two or three lines thick, of a greyish-red colour, breaking with a short fracture, and exposing lighter-coloured surfaces, mottled with red and white. The pieces from the root are rougher externally and more frequently destitute of epidermis. The odour is feeble; the taste bitter and astringent, with a little aroma. In the fresh state the taste is a little acrid.

Chemical Composition.—Dr. Walker, who analysed the bark, announced that it contained *gum*, *resin*, *tannin*, and *gallic acid*. To these have since been added, by Mr. Cockburn,[1] *oil*, *fatty matter*, a *crystalline substance*, *bitter extractive*, *wax*, *red colouring matter*, *lignin*, and *potassa*, *iron*, *lime*, and *magnesia*. From his experiments, it appeared that the bitterness alone resided in the extractive matter, from which the crystalline substance was obtained.

A principle, to which the name *cornine* was given, was several years since announced, but has not been subsequently obtained by analysis.

Medicinal Properties.—Dogwood bark is a decided roborant, and has been placed by American physicians in the list of tonics. Dr. Walker found that it augmented the force and frequency of the pulse and increased the heat of the body. It has also an astringent effect. An analogy has been supposed to exist between its mode of operation and that of cinchona, but it does not seem to be possessed of more than a general invigorating effect. As a substitute for bark or its preparations, dogwood has been employed in the treatment of intermittent fever, and in domestic practice it is much used. Advantage has also been derived from it in the hands of regular practitioners. The objection to its use, however, is the large doses required, which disorder the stomach. As a mere tonic it is applicable to the same range of cases as its congeners. The recent bark is apt to disagree with the stomach and produce pain.[2]

Dogwood bark may be given in powder, infusion, decoction, or extract. The dose in substance is ℈j to ʒj.

DECOCTUM CORNUS FLORIDÆ, U. S.; *Decoction of Dogwood Bark.*—(Take of Dogwood, bruised, an ounce; Water a pint. Boil for ten minutes in a covered vessel, and strain the liquor while hot.)—Dose, f℥j. to ℥iij.

Two other species of Cornus, the C. circinata and C. sericea, have been placed in the secondary list of the *United States Pharmacopœia.* Both of these are shrubs. The bark is in the quilled form. The medical properties are nearly similar to those of the *C. florida.* They are employed in the same way and for the same purposes.—Ed.]

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[1] *Am. Journ. of Pharm.* vol. vii. p. 114.

[2] [For a full description of the medicinal properties of dogwood, see *Trans. Amer. Med. Assoc.*, 1849, vol. ii. p. 670.—Ed.]

MIXED PRODUCTS.

367. CREASOTON, *L.*—CREASOTE.

Creazotum, *E.*—Creasotum, *D.*

(Oxy-hydro-carburetum; ex oleo pyroxylico præparatum, *L.*)

History.—This substance was discovered a few years since by Reichenbach, who termed it *Creasote* (from *κρέας*, *flesh*, and *σώζω*, *I preserve*), or the *flesh-preserver*, on account of its antiseptic property. Its name is sometimes written *Creosote*, or *Kreosote.*

Natural History.—It is an artificial product; and is obtained by the destructive distillation of organic substances. It is found in pyroligneous acid, in tar, in Dippel's oil, in wood smoke, and empyreumatic waters.

Preparation.—The preparation of creasote is a very troublesome and tedious process. The following concise abstract of it is taken from Turner's *Elements of Chemistry* (5th edit. p. 872). Those portions of the oil (called in the Pharmacopœia *pyroxylic oil*) distilled from wood-tar, which are heavier than water, are first freed from adhering acetic acid by carbonate of potash, and, after separation from the acetate, are distilled. A little phosphoric acid is mixed with the product to neutralise ammonia, and another distillation resorted to. It is next mixed with a strong solution of potash, which combines with creasote, allows any eupion which may be present to collect on its surface, and by digestion decomposes other organic matter: the alkaline solution is then neutralised by sulphuric acid, and the oil which separates is collected and distilled. For the complete purification of the *creasote*, this treatment with potash, followed by neutralisation and distillation, requires to be frequently repeated.[1] The oil from which creasote is prepared is that obtained by the distillation of wood-tar, and is either imported from Stockholm, Archangel, and America, or is made in the manufacture of pyroligneous acid. [Good tar from beech wood is said to contain from 20 to 25 per cent. of creasote. The tar of peat contains it, and it also occurs in coal-tar.[2]—Ed.]

Properties.—Pure creasote is colourless and transparent; it has a high refractive power, and an oleaginous consistence. Its odour is that of smoked meat, its taste burning and caustic, its sp. gr. 1·037 at 68° F. [According to the Dublin Pharmacopœia, its sp. gr. is 1·066, and Ph. L. 1·046.—Ed.] It boils at 397° F.; and is fluid at −16·6° F. It is combustible, burning with a sooty flame. It absorbs chlorine, and is resinified by it. Nitric acid is decomposed by it, with the evolution of nitrous fumes. Sulphuric acid in small quantity reddens, and in large quantity blackens it. Potassium decomposes it, with the evolution of gas (hydrogen?) and the formation of potash, which combines with some inspissated creasote. It is soluble in alcohol, ether, sulphuret of carbon, eupion, naphtha, acetic acid, and acetic ether. It dissolves resins, camphor, fats, and essential oils, various colouring matters (as indigo, cochineal, saffron, and madder), and some salts (as the acetate of potash). It has very little action on caoutchouc, and does not possess any acid or alkaline re-action on test paper. Mixed with water, it forms two combinations: one is a solution of 1·25 parts of creasote in 100 of water; the other, on the contrary, is a solution of 10 parts of water in 100 of creasote. It coagulates soluble albumen. Concentrated albuminous liquids are immediately coagulated by it; diluted ones, gradually. Fibrin is not altered by it. It is powerfully antiseptic with respect to meat and fish.[1] Tar, smoke, and crude pyroligneous acid, owe part, if not the whole, of their antiseptic properties to it. According to Dr. J. R. Cormack,[2] the only essential part of the mummifying process practised by the ancient Egyptians was the application of such a heat as would first dry up the body, and then decompose the tarry matters which had been previously introduced, and thus generate creasote.

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[1] For further details I must refer to Dumas' *Traité de Chimie;* the *Ann. de Chim. et Phys.* t. 57, 1834; and Cozzi, in the *Journal de Pharmacie,* t. xxviii. p. 629.

[[2] Gregory's *Organic Chemistry,* 464. This writer also gives a description of an improved method of preparing creasote.—Ed.]

CHARACTERISTICS.—The odour of creasote is its most characteristic property. It is that of peat smoke, strong, peculiar, and persistent. To this must be added its combustibility, its oleaginous appearance, its complete solubility in acetic acid and caustic potash, and its action on albumen before mentioned.

IMPURITY.—Creasote, when pure, is perfectly colourless and should remain so; but that met with in commerce has frequently a more or less brownish tinge. Rectified oil of tar, capnomor, and a substance like almond oil, have been mixed with it.[3] These impurities are readily detected by mixing separate portions of the suspected liquid with acetic acid and caustic potash: pure creasote is completely soluble in these fluids; not so the adulterated. Capnomor is similar to creasote in many of its physical and chemical properties, and is frequently associated with the creasote of the shops.

Colourless; peculiar odour; sp. gr. 1·046; volatilised on paper without leaving a greasy stain.—*Ph. L.*

COMPOSITION.—Ettling[4] analysed creasote which was supposed to contain three per cent. of water. Making allowance for this impurity, its composition, as determined by this chemist, is nearly as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Carbon	14	84	77·42
Hydrogen	9	9	8·12
Oxygen	2	16	14·46
Creasote	1	109	100·00

or $C^{14}H^{9}O^{2}$. At present, however, the equivalent of creasote must be considered as uncertain, since no definite compound of this substance has been analysed, by which the combining proportion could be ascertained.

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—Plants moistened with creasote water fade and die.[5] The injurious effects of smoke on vegetation are probably to be referred principally to the creasote which it contains.

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[1] [If meat or fish be thoroughly impregnated with creasote, it does not readily undergo putrefaction. A solution of it is commercially used for flavouring and preserving tongues and hams.—ED.]

[2] *Treatise on Creosote.* Edinburgh, 1836.

[3] Cormack, *op. cit.*

[4] *Ann. de Chimie*, liii. p. 333.

[5] Miguet, *Recherches sur la Créasote*, 1834.

β. *On Animals generally.*—Insects (as flies), spiders, and small fishes, die in two minutes after their immersion in water containing a few drops of creasote suspended in it. According to Dr. Cormack, the effects of creasote on dogs are remarkably similar to those of hydrocyanic acid, and are much less apparent when this substance is injected into the carotid arteries than into the veins. When thrown into the latter it suddenly stops the heart's action, and causes hurried respiration, one or two convulsive fits, shrill cries, and death. Injected into the carotid artery it produces coma. Introduced into the stomach it gives rise to dimness and fixation of the eyes, vertigo, and coma: when given in large quantities it also affects the heart.[1] Corneliani[2] and Miguet have observed inflammation of the gastro-intestinal mucous membrane of dogs poisoned by creasote, but which survived some time after its administration.

γ. *On Man.*—Creasote operates locally as an irritant and caustic. In a concentrated state it is an irritant poison. Applied to the skin it causes heat, redness, and the destruction of the cuticle, which comes away in the form of furfuraceous scales. On the tongue it produces a painful sensation. Dropped into the eye it occasions acute pain. Placed in contact with a suppurating surface it whitens the part, like nitrate of silver. Swallowed in large doses it causes vomiting and purging. The caustic effect of creasote depends on its union with albumen. Unless largely diluted, it occasions, when swallowed, heat in the pharynx, œsophagus, and stomach. Small doses, as one or two minims, produce in most individuals no other unpleasant effect than that just mentioned. Larger doses give rise to nausea, vomiting, vertigo, headache, and heat of head. Dr. Elliotson[3] knew a lady who increased the dose of creasote to forty drops before it disagreed: the addition of a single drop beyond this produced extreme giddiness, insensibility, and vomiting, followed by headache for several days. When given in moderate doses it does not affect the bowels; so that, as Dr. Elliotson has observed, "aperients are as requisite as if it was not taken." When, however, the dose has been considerably augmented, diarrhœa, or even dysentery, has been produced.[4] The influence of creasote on the urinary organs is sometimes very marked. Dr. Macleod[5] was, I believe, the first who noticed that the urine acquired a blackish colour by the use of it. A similar effect is referred to by Dr. Elliotson. In some cases creasote is recognised, by its odour, in the urine, showing that it has been absorbed. Occasionally it increases the quantity of this secretion; but in diabetes it sometimes has an opposite effect. In some instances it has caused micturition and strangury, so that in its influence over the urinary organs it bears some resemblance to turpentine. Some other effects which have been ascribed to it require further evidence to establish them. In the dose of two drachms creasote proved fatal in thirty-six hours. It caused acute pain[6]

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[1] Cormack, *op. cit.* p. 66, et seq.

[2] *Jour. Chem. Méd.* t. ii. ser. 10; and *Brit. & For. Med. Rev.* vol. i. p. 265.

[3] *Medico-Chirur. Trans.* vol. xix.

[4] Cormack, *op. cit.* p. 93.

[5] *Lond. Med. Gaz.* vol. xvi. p. 599; and vol. xvii. p. 653.

[6] See *The Times* of June 17, 1839. I presume the mental faculties were unaffected.

USES.—Various substances, some known to contain creasote, others supposed to do so, have long been used in medicine, in the same diseases in which creasote itself is now employed; and, in consequence, it has been imagined that they owe part of whatever efficacy they really possess to this substance. These remarks apply to Tar,[1] Soot,[2] Crude Pyroligneous Acid, *Aqua Binelli*,[3] the Empyreumatic Water of Runge and Hanke, Pyrothonide,[4] and Animal or Dippel's Oil. To this list should be added, according to Dr. Cormack (*op. cit.*), Mummy.

As an *internal* remedy, creasote has been principally celebrated, in this country, as a medicine possessing extraordinary powers of arresting vomiting. It has, however, been greatly overrated. It is decidedly injurious in inflammatory conditions and structural disease of the stomach, and frequently fails in allaying the sickness dependent on organic diseases, as of the heart and kidneys. It is most successful in hysterical cases, and sometimes succeeds in pregnancy. Creasote was first employed to relieve vomiting by Dr. Elliotson,[5] to whose paper, as well as to that of Mr. Taylor, apothecary of the North London Hospital,[6] I must refer for cases illustrative of extraordinary success with it. It is regarded by Dr. Macleod[7] as of doubtful efficacy; and has completely failed in the hands of Dr. Paris.[8] Dr. Burne,[9] however, found it efficacious in gastro-enteritic irritation. I have found it much more frequently fail than succeed in alleviating irritable stomach. It sometimes relieves the chronic vomiting connected with granular disease of the kidneys when other means fail.[1] In *gastrodynia* or *flatulence* it occasionally succeeds, but is admissible in those cases only in which local stimulants are usually found beneficial. Where both hydrocyanic acid and creasote have been separately tried without success, Dr. Elliotson advises their union. Creasote has been tried in a few cases of *diabetes*. In some it diminished both the quantity and saccharine quality of the urine.[2] I have tried it at the London Hospital, but without obtaining benefit from its use. In neuralgia, hysteria, and pulmonary diseases, it has also been used with occasional advantage: but a more extended experience is required to establish its efficacy in these cases.

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[1] Tar has been already described, Pt. 1. Vol. II. p. 321.

[2] WOOD SOOT (*Fuligo Ligni*) was formerly contained in the list ofthe materia medica of the British Pharmacopœias. It is still in use on the continent, and statements of its efficacy are occasionally met with in the periodicals. It is a mixture of distilled products from the imperfectly burnt wood and of ashes, or other fixed matters, carried up the chimney by the current of air. It consists of a pyrogenous or empyreumatic resin called *pyretin*, combined with *acetic acid*, which also saturates the bases (*potash*, *lime*, and *magnesia*) of the ashes which are carried up the chimney. Besides these, there are small quantities of *sesquioxide of iron*, *silica*, and *carbon*. *Acetate of ammonia*, *chloride of calcium*, and *sulphate of lime*, are also contained in soot. Moreover, there is *extractive matter*, part of which is insoluble in alcohol. Lastly, to these constituents must be added *creasote*. Braconnot (*Ann. Chim. et Phys.* t. xxxi., p. 37) mentions a bitter principle, which he calls *asboline* (from ἀσβόλη, soot) in soot; but Berzelius (*Traité de Chemie*, t. vi. p. 725) considers it to be a mixture of different matters with the acid pyretine. The matters insoluble in water constitute about 0·44 of soot. Formerly soot was esteemed tonic, antispasmodic, and emmenagogue. It is now principally employed as an external remedy, chiefly in ringworm and other analogous eruptions, and obstinate ulcers. It is employed in the form of *decoction* (prepared by boiling two handfuls of soot in a pint of water for half an hour) and of *ointment* (composed of a drachm of soot to an ounce of lard). The decoction has been used as an injection in chronic cystitis (*Lond. Med. Gaz.* 1839–40, vol. i. p. 864). The *Tincture of Soot*, formerly in the London Pharmacopœia, consists of Wood Soot ℥ij.; Assafœtida, ℥j.; and Proof Spirit, f℥xxxij. It is sometimes called *Soot Drops* or *Hysteric Mixture*, and is prescribed in doses of one or two teaspoonfuls in hysteria.

[3] AQUA BINELLI, or *Aqua arterialis balsamica Doctoris Binelli*, a once-celebrated styptic, discovered by a physician (Dr. Binelli) of Turin, in 1797 (Dierbach (*Neuesten Entdeck. in d. Mat. Med.* 2te Ausg. 1837). See also Dr. J. Davy, *Edinb. Med. and Surg. Journ.* July, 1833.

[4] PYROTHONIDE (from πῦρ, *fire*; and ὀθόνη, *linen*), or *liquor pyro-oleosus e linteo paratus*, is a very popular remedy for toothache and skin diseases. It is sometimes prepared by distilling rags, and is then called *rag oil*; but the common mode of procuring it is to burn a cone of paper on a plate or other cold body; it is then termed *paper oil*. It has been analysed by Herberger (Buchner, *Repertorium*, Bd. 32, S. 347). For further particulars concerning it, consult Merat and De Lens, *Dict. Mat. Méd.*; Dierbach, *op. cit.*; Schwartze, *Pharm. Tabell.* 2te Aus.; L. Richter, *Ausführl. Arzneim.* Supplem. Bd.

[5] *Medico-Chirurg. Trans.* vol. xix.

[6] *Lancet*, August 15, 1835.

[7] *London Medical Gazette*, vol. xvi. p. 598, and vol. xvii. p. 653.

[8] *Appendix* to the 8th edit. of the *Pharmacologia*, 1838.

[9] *London Medical Gazette*, August 18th, 1838.

[*In Dysentery and Diarrhœa.*—In a very wide-spread epidemic, Dr. Andree found the aqua creasoti of the Swedish Pharmacopœia (ʒi. ad ℥xij. aq. dest.) very useful. A teaspoonful was given to adults every two hours, and a drop for each year of age to children. It was useful only at an early stage, opium being the remedy at a later. Dr. Hellmann employed it with benefit; but some practitioners state that those patients who took the aqua as a prophylactic of their own accord were liable to attacks of dysentery.[3]

Mr. Spinks,[4] and Mr. Kesteven,[5] have published cases which show the successful employment of creasote in common diarrhœa. The dose given to adults was from two to five drops every three, four, or six hours, combined with compound spirit of ammonia. It was seldom found by these gentlemen that the medicine required repetition beyond the second dose. It is particularly serviceable in such cases, on account of its control over the nausea or vomiting which frequently attends diarrhœa.—ED.]

As an *external* agent creasote may frequently be employed with great advantage. It has been successfully applied to relieve *toothache*. After carefully cleaning out the cavity of the tooth, a drop of creasote, or an *alcoholic solution* of it, may be introduced by means of a camel's hair pencil, and the cavity filled with cotton soaked in the liquid. As a local application to chronic skin diseases (particularly the different forms of porrigo, impetigo, eczema) it is of considerable value. Where a caustic application is required, it may be applied undiluted; but for other purposes it is used either in the form of ointment, or dissolved in water as a wash. Creasote may be beneficially used as an application to foul and indolent ulcers. It serves the double purpose of stimulating the living surface (and thereby of changing the quality of actions going on in the part), and also of preventing the putrefaction of the secreted matters. It is sometimes applied pure, but more commonly diluted with water. Lupus is said to have healed under the employment of an ointment of creasote.[6] In hemorrhages creasote acts as a most efficient styptic, partly in consequence of its power of coagulating albuminous liquids, and thereby of causing the formation of a clot, and partly by causing contraction of the bleeding vessels. *Creasote water* (prepared by mixing one part of creasote with eighty parts of water) may be applied either to bleeding wounds and leech-bites, or introduced into the vagina in uterine hemorrhage, by means of pledgets of lint soaked in it. There are many other purposes for which creasote has been applied as a local agent, but which I think it sufficient merely to name, referring the reader to the various papers and works before quoted for further information. It has been employed to check caries, to restrain excessive suppuration, and to repress fungous granulations in burns and scalds; to act as a counter-irritant in chronic ophthalmia, in which disease it is sometimes dropped into the eye on the same principle that nitrate of silver and other local stimulants are used; and to remove condylomatous and other excrescences. The inhalation of creasote vapour is occasionally useful in relieving excessive bronchial secretion. Dr. Elliotson cured two cases of glanders in the human subject by injecting an aqueous solution of creasote up the affected nostril.[1]

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[1] See Christison, *On Granular Degeneration of the Kidneys*, Edinb. 1839.

[2] Dr. Elliotson, *Med.-Chirurg. Trans.;* and Professor Berndt, *Lancet*, July 18, 1835.

[3] Schmidt's *Jahrb.* xci. p. 29, *Med. Times and Gazette*, Nov. 1856.

[4] *Lond. Med. Gaz.* 1849, N. S. vol. ix. p. 254.

[5] *Ibid.* 1851, N. S. vol. xii. p. 235.

[6] Mr. Browne, in the *London Medical Gazette* for April 7, 1838.

ADMINISTRATION.—Creasote may be given, at the commencement of its use, in doses of one or two drops diffused through an ounce of some aromatic water by the aid of mucilage: the dose should be gradually increased. As before mentioned, in one case forty drops were given with impunity: in another instance, ninety drops were administered in less than half a day without any bad symptom.[2] As a *caustic*, undiluted creasote is sometimes applied by means of a camel's hair pencil. Lotions, gargles, or injections of creasote, are prepared by dissolving from two to six drops (according to the circumstances of each case) in an ounce of water. A solution of this kind is sometimes mixed with poultices.

The inhalation of creasote vapour may be effected by diffusing a few drops of creasote through water or a mucilaginous liquid, and breathing through this by means of the ordinary inhaling bottle.

ANTIDOTES.—In a case of poisoning by creasote, the depression of the vital powers is to be counteracted by ammonia and other stimulants. Dr. Cormack suggests the use of chlorine, but the value of this agent has not been determined by actual experiment. Oleaginous and mucilaginous drinks have been recommended for the purpose of preventing the local action of creasote on the mucous lining of the stomach and intestines. Vinegar does not diminish, but, according to Corneliani, increases, its activity. Dr. Cormack says albumen augments [?] its poisonous operation. Bleeding is suggested by this writer, in order to relieve the distension, and thereby to excite the contractions, of the heart. Artificial respiration should on no account be omitted. Any inflammatory symptoms which may subsequently appear are of course to be treated by the usual antiphlogistic measures.

1. MISTURA CREASOTI, *Mistura Creazotæ*, E. ("Take of Creazote and Acetic Acid, of each, ♏xvj.; Compound Spirit of Juniper, and Syrup, of each, f℥j.; Water, f℥xiv.; mix the creazote with the acid, then gradually [add] the water, and lastly the syrup and spirit). Dose f℥j. to f℥ij. or more.

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[1] See also *Lancet*, vol. ii. for 1834–5, p. 398.

[2] Mr. Taylor, *Lancet*, August 15, 1835.

[2. **SOLUTIO CREASOTI AQUOSA.** *Pharm. Norveg.* *Aqueous Solution of Creasote.* Take of Creasote, one part; of Distilled Water, ninety-nine parts. Mix and dissolve.—Ed.]

3. **UNGUENTUM CREASOTI,** L. D.; *Unguentum Creazoti,* E. (Creasote, fʒss.; Lard, ℥j. rub them together *L.*—Axunge, ℥iij.; Creazote, ʒj. Melt the axunge, add the creazote, stir them briskly, and continue to do so as the mixture concretes on cooling, *E.* Take of Creazote, ʒj.; Ointment of White Wax, ʒvij. To the ointment liquefied by a moderate heat add the creasote, and stir constantly until the mixture concretes, *D.*)—It is used principally in skin diseases, as ring-worm. The quantity of creasote may be augmented or lessened according to circumstances.

368. PETROLEUM, *L. E.*—PETROLEUM, OR ROCK OIL.

Petroleum, *L.* (Petroleum Barbadense, *E.*)

Bitumen liquidum nigricans e terrâ sponte manans, *L.*

History.—Herodotus[1] mentions the petroleum springs of Zacynthus (now called Zante) more than 400 years before Christ. Plutarch, in his Life of Alexander, speaks of a lake of naphtha at Ecbatana (now Hamedan), in Media. The substance known to mineralogists as petroleum is the *black naphtha* (νάφθα μέλαινα) of Dioscorides (lib. i.), the *bitumen liquidum* of Pliny (lib. xxxv.).

Natural History.—There are two varieties of liquid bitumen or mineral oil: one is transparent and nearly colourless, or only slightly yellow, and when burnt leaves no residuum; the other is thick, of a reddish brown colour or blackish, and leaves, after combustion, a black coal. The first is called *naphtha* (a Chaldæan word); the second *petroleum* (from *petra*, a rock; and *oleum*, oil) or *rock oil*, because it is frequently found exuding in the form of an oily liquid from rocks. Both kinds are supposed to be produced by the decomposition of organic (vegetable) matter, for they are always found in Neptunian rocks, and they appear sometimes to be one of the products of the decomposition of coal.[2] From the investigation of Drs. Christison and Gregory,[3] it appears probable that some varieties of petroleum, as that of Rangoon, are products of destructive distillation, since they contain paraffine, and eupion, substances obtained from organic bodies by heat.

Petroleum is found in this country at Ormskirk in Lancashire, at Colebrook Dale, and at St. Catherine's Well, near Edinburgh. In France it is produced at the village of Gabian in Languedoc, and hence it was termed *Oleum Gabianum.* It is also found in various other parts of Europe, especially in Italy. In the United States of America it is met with in various places: that from the shore of Seneka Lake in New York is called *Seneka Oil.* Several of the West India Islands, especially

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[1] *Melpomene*, cxcv.

[2] Berzelius, *Traité de Chim.* t. vi^{me}.

[3] *Trans. of the Roy. Soc. Edinb.* vol. xiii. p. 1.

Barbadoes and Trinidad, yield it. The Barbadoes petroleum (*Petroleum Barbadense*, L.; *Pisselæum Indicum*, Dale) is commonly termed *Barbadoes Tar*, or *Barbadoes Naphtha*. Mr. Hughes[1] speaks of two kinds of it; one of a dirty black, inclining to a green, issuing from some hills in St. Andrew's and St. Joseph's parishes; and one of a blacker colour, in St. Joseph's parish. That imported by Mr. Clarke professes to be the produce of the springs on Mount Hall estate, in Barbadoes. In various localities of Asia petroleum is met with in great abundance.

EXTRACTION.—Mr. Hughes says that the mode of procuring the green tar of Barbadoes is to dig a hole or trench in, or very near, the place where it oozes out of the earth. This by degrees becomes filled with water, having a thick film or cream of this liquid bitumen swimming upon the surface; from whence it is skimmed off, and preserved in earthen jars or other vessels. The most convenient season for gathering it is in the months of January, February, and March.

PROPERTIES.—Barbadoes petroleum, at ordinary temperatures, has the consistence of treacle: its colour is reddish brown or blackish; its odour and taste are bituminous. It floats on water: is combustible, yielding a thick black smoke, and leaving a carbonaceous residuum. It is insoluble in water and alcohol.

COMPOSITION.—The ultimate constituents of Barbadoes petroleum are *carbon* and *hydrogen*, with small quantities of *oxygen* and *nitrogen*. The latter probably are accidental. By distillation, five parts by measure yield rather more than four parts of *a yellow oily fluid*, somewhat similar in appearance to the liquid carbo-hydrogen obtained in the manufacture of oil-gas, but dissimilar to naphtha. The residuum in the retort is a substance analogous to *asphaltum*. It yields by destructive distillation traces of ammonia. Some kinds of petroleum contain paraffine and eupion.

PHYSIOLOGICAL EFFECTS.—Petroleum possesses stimulating properties, which are principally observed in its effects on the organs of secretion (the skin, the kidneys, and the mucous membranes), the activity of which it promotes: hence it has been called sudorific, diuretic, and expectorant. It becomes absorbed, and in this way probably acts topically on the secreting organs; for Mr. Hughes observes, that when a horse "that has been dosed with it begins to be warm upon his journey, the rider will smell the tar strongly." It is said to be an excitant to the lymphatic vessels and glands.

USES.—As an internal remedy it is employed in chronic pulmonary affections (as winter coughs and old asthmas), in obstinate skin diseases (as lepra, psoriasis, and impetigo), and against tape-worm. Mr. Hughes says it is used in paralytic and nervous disorders. As an external agent it is applied to obstinate ulcers, as lupus and cutaneous diseases, and is employed as a stimulating liniment in chronic rheumatism, paralysis, and chilblains.

ADMINISTRATION.—The dose of Barbadoes petroleum is a small tea-spoonful given in any convenient vehicle (as some aromatic water, tea, or spirit). The quantity should be gradually increased. An ounce has been taken in a day without any inconvenience.

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[1] *The Natural History of Barbadoes*, p. 50. Lond. 1750.

369. SUCCINUM, *D.*—AMBER.

(The oil obtained by its destructive distillation, *D.*)

HISTORY.—Amber was known to Thales of Miletus, 600 years before Christ. He was the first who noticed that, when rubbed, it acquired the power of attracting light bodies. Hence arose the term electricity, from *ηλέκτρον, amber*. Theophrastus[1] also mentions this property.

NATURAL HISTORY.—Amber is found in different parts of the world. The principal portion of that met with in commerce comes from the southern coasts of the Baltic, in Prussia, and is cast on the shore between Königsberg and Memel. It is also found on the coast of Norfolk. It is supposed to be disengaged, by the action of the sea from submarine beds of lignite. The vegetable origin of amber is shown by various facts. It is usually associated with substances (bituminous wood, coal, &c.) known to be derived from plants. Externally we observe on it various impressions of the branches and barks of trees; and inclosed in it are insects and parts of plants (as the wood, leaves, flowers, and fruit). According to Sir David Brewster,[2] its optical properties are those of an indurated vegetable juice. From these circumstances, as well as from its chemical composition, amber is supposed to have been a resinous exudation from some tree. As the wood, leaves, blossoms, and fruit of some coniferous plant are found in amber, this plant has been supposed to be the amber tree: and a microscopic examination of the wood leads to the conclusion that the amber tree is a species, though probably an extinct one, of the genus Pinus, closely allied to P. balsamea.[3] On chemical grounds, however, Liebig[4] suggests that it is a product of wax, or of some other substance allied to the fats of fixed oils; since succinic acid is formed by the oxidation of stearic and margaric acids.[5]

PROPERTIES.—It occurs in irregularly shaped pieces, usually flat and somewhat rounded at the sides. Its colour is yellowish white (*succinum album*), yellow (*succinum citrinum*), or reddish (*succinum rubrum*). It is usually translucent, sometimes opaque or transparent: it is tasteless and odourless. Its sp. gr. is about 1·07. It is brittle, yields readily to the knife, has a conchoidal vitreous or resinous fracture, and becomes negatively electrical by friction: it contains various insects which, apparently, must have become entangled in it while it was soft and viscid. (For an account of these consult Mr. Hope's paper before quoted; also Burmeister's *Manual of Entomology*, p. 574).

Heated in the air, amber fuses at about 550° F., then inflames, and burns with a yellow flame, emitting a peculiar odour, and leaving behind a light shiny black coal. It cannot be fused without undergoing some chemical change. It evolves water, volatile oil, and succinic acid: the residual mass is termed *colophonium succini*. By destructive distillation in a retort or alembic, amber yields first an acid liquor (which contains succinic and acetic acids), then some succinic acid is deposited in the neck of the retort, and an empyreumatic oil (*oleum succini*) comes over, at first thin and yellowish, afterwards brown and thick: towards the end of the operation a yellow light sublimate is observed in the neck of the retort; this is called, by Berzelius, *crystallised pyrétine;* by Vogel, *volatile resin of amber;* by Gmelin, *amber-camphor*. An inflammable gas is evolved during the whole time of the operation.

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[1] *De Lapidibus.*

[2] *Edinburgh Philosophical Journal*, vol. ii.

[3] Hope, *On Succinic Insects*, in *Trans. Entom. Soc.*, vols. i. and ii. See also Sendelius, *Historia Succinorum*, Lips. 1742.

[4] Turner's *Elements of Chemistry*, 7th edit. p. 1050.

[5] For further details respecting the natural history of amber, consult John's *Naturgeschichte d. Succins*, Coln. 1816; and Graftenhauer's *Histoire Naturelle, chimique, et technique, du Succin*, Paris, 1824.

COMPOSITION.—The *ultimate* constituents of amber are, *carbon, hydrogen*, and *oxygen*. The *proximate* principles are, a *volatile oil, two resins, succinic acid*, and a *bituminous substance.*

Ultimate Constituents.			*Proximate Constituents.*
	Drassier.	*Ure.*	*Berzelius.*
Carbon	80·59	70·68	Volatile Oil.
Hydrogen	7·31	11·62	Two Resins.
Oxygen	6·73	7·77	Succinic Acid.
Ashes (silica, lime, and alumina)...	3·27	—	Bitumen.
Amber	97·90	90·07	Amber.

According to Hünefeldt, hydrochloric acid extracts from amber, besides succinic acid, another acid, very similar to *mellitic acid.*

The *volatile oil* has a strong but agreeable odour. The *resins* are soluble in both alcohol and ether: if an alcoholic solution of the two resins be prepared by heat, and then allowed to cool, one of the resins is deposited. The *bituminous matter* constitutes the principal part of amber: it is insoluble in alcohol, ether, the oils both volatile and fixed, and alkaline solutions. [It is very readily dissolved by chloroform, and constitutes the well-known amber varnish used in photography.—ED.]

CHARACTERISTICS AND PURITY.—The resins copal and animi are sometimes substituted for amber. They may be distinguished by the difference in their colour and fracture, and by their not emitting the peculiar odour of amber when thrown upon hot iron.[1] They do not yield succinic acid when submitted to distillation. Copal, during its combustion, is constantly falling in drops; and by this character may be distinguished from amber.[2]

PHYSIOLOGICAL EFFECTS.—Amber was formerly celebrated as a stimulant and antispasmodic. It probably possesses little or no medicinal power.

USES.—It is not employed as a medicine in this country. It was formerly used in chronic catarrhs, amenorrhœa, hysteria, &c., and was given either in the form of powder, in doses of from ten grains to a drachm, or in that of tincture, a formula for which is contained both in the French Codex and Prussian Pharmacopœia.

1. OLEUM SUCCINI, D.; *Oil of Amber.*—No directions for the preparation of this oil are given in the Dublin Pharmacopœia.

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[1] *United States Dispensatory.*

[2] Kidd's *Outlines of Mineralogy*, vol. ii. p. 38. Oxford, 1809.

The following mode of preparing this oil I have seen practised by an experienced manufacturer:—The amber is distilled in a large iron still or retort, set in brickwork over a proper fire, and connected with an earthen globe, which opens into an old oil jar for a receiver. Three distilled products are obtained: impure succinic acid, called *volatile salt of amber;* an aqueous liquor, termed *volatile spirit of amber*, consisting of water, acetic and succinic acid, and pyrogenous oil; and *volatile oil of amber*. The residue in the retort is a kind of pitch, and is called *English asphalt*. The oil is afterwards rectified by distillation in an iron pot, to which an earthen head is adapted. A very gentle heat suffices for redistillation. Scrapings of Copal and the resin Dammara are frequently substituted for amber. They yield no succinic acid, but a volatile oil scarcely distinguishable from genuine oil of amber.

Volatile oil of amber, when fresh drawn, has a pale yellowish colour, which deepens by age, and a strong and remarkable, but agreeable, odour. It is a powerful local irritant. When rubbed on the skin it acts as a rubefacient, and is sometimes employed in liniments in rheumatism and paralysis. Taken internally it operates, like most other empyreumatic oils, on the nervous system, and is used as a stimulant, antispasmodic, and emmenagogue, in hysteria and amenorrhœa. The dose is from ten to fifteen drops. It is a constituent of the *Tinctura Ammoniæ composita*, which is made in imitation of *Eau de Luce*, the history of which has been fully detailed by Beckmann.[1]

ARTIFICIAL MUSK (*Moschus artificialis; Moschus factitius*) is prepared by adding gradually f℥iiiss. of concentrated nitric acid to f℥j. of oil of amber, in a large glass tumbler. When the acid is not of sufficient strength, its action must be assisted by heat. The oil is gradually resinified at the expense of the oxygen of the acid, nitrous fumes being evolved. An orange yellow resin, having a peculiar musky odour, is obtained; which is to be well washed with water to remove all traces of acid. Artificial musk is reputed to be antispasmodic and nervine, and has been employed in hooping-cough, and low nervous fevers. A tincture of it (*Tinctura Moschi artificialis*) is prepared by dissolving ℥j. of artificial musk in f℥x. of rectified spirit. The dose is f℥j.

2. ACIDUM SUCCINICUM; *Succinic Acid*, or the *Acid of Amber; Sal Succini.*—This acid is obtained in the distillation of amber. The mode of purifying it has been already stated. It may also be procured by the oxidation of stearic and margaric acids. It crystallises in colourless white scales or prisms, which are quite volatile. Anhydrous succinic acid is composed of $C^4H^2O^3=50$. The sublimed acid is composed of $2\bar{S}+HO=109$. It is soluble in water; scarcely so in cold, but more so in boiling, alcohol. It is almost insoluble in oil of turpentine, by which it is distinguished from benzoic acid. Succinate of ammonia produces, with the salts of the sesquioxide of iron, a brownish red, flaky precipitate (*persuccinate of iron*), and with the salts of lead, a white precipitate (*succinate of lead*). Succinic acid is said to possess stimulant and antispasmodic properties, and to promote perspiration and excretion of urine. It was formerly employed in rheumatism, gout, suppressed or repressed eruptions, and cramps. It is now never used in medicine. The dose in which it was formerly given was grs. v. to grs. xv.

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[1] *History of Inventions and Discoveries*, 2d edit. vol. iv. p. 595, Lond. 1814.

II. The Animal Sub-Kingdom.

Division I. Invertebrata.—Invertebral Animals.

Characters.—Animals destitute of a *vertebral column* and an *internal skeleton*. *Skin* sometimes ossified, and thereby forming an *external skeleton*. *Nervous system* not always evident.

Subdivision I. ACRITA, *Macleay*.

Nervous system indistinct, diffused, or molecular (Owen).[1]

Class I. Poriphera, *Grant*.—Poripherous Animals.

Characters.—Simple, soft, aquatic *animals*, with a fibrous *axis*, without perceptible *nerves* or *muscular filaments*, or *organs of sense*, or any *circulating* or *glandular organs*. Their body is composed of a soft gelatinous *flesh*, traversed internally with numerous ramose, anastomosing canals, which commence from superficial minute *pores*, and terminate in larger, open *vents*.[2]

370. SPONGIA OFFICINALIS, *Linn. E.*—THE OFFICINAL SPONGE.

(Sponge, *E.*)

History.—Aristotle[3] was acquainted with the sponges, and notices the popular but erroneous opinion of their shrinking when attempted to be plucked.

Zoology. Gen. Char.—Body soft, very elastic, multiform, more or less irregular, very porous, traversed by numerous tortuous canals, which open externally by very distinct vents (*oscula*), and composed of a kind of sub-cartilaginous *skeleton*, anastomosed in every direction, and entirely without spicules (De Blainville).[4]

My friend, Mr. J. S. Bowerbank,[5] has recently shown that spicula do exist in the keratose or horny sponges of commerce. They are imbedded, to a greater or less extent, in the substance of the fibre, and are mostly to be observed in the larger flattened portions of the fibre, and not in the finer anastomosing threads. Mr. Bowerbank has also shown that the fibre of the true sponges is solid, and not tubular, as commonly supposed.[6]

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[1] *Cyclop. of Anat.* art. *Acrita.*

[2] Grant, *Brit. Annual* for 1838, p. 267.

[3] *Hist. d. Anim.* lib. i. cap. ix. p. 16, Tolosæ, 1619.

[4] *Man. d'Actinol.* p. 529, 1834.

[5] *The Microscopic Journal*, i. 8.

[6] The only tubular sponge known to Mr. Bowerbank is *Spongia fistularis*. This, however, he proposes to separate from the genus Spongia, and to give it the generic name of *Fistularia*.

Sp. Char.—*Masses* very large, flattened and slightly convex above, soft, tenacious, coarsely porous, cracked and lacunose, especially beneath. *Vents* round, and for the most part large (Lamouroux).[1]

These characters are insufficient to distinguish the officinal sponge from numerous other allied species; and it is tolerably clear, from Mr. Bowerbank's discoveries, above alluded to, that the naked eye is incompetent to distinguish species of this curious genus, and that the microscope must be principally, if not wholly, relied on for ascertaining specific characters. Mr. Bowerbank has recognised three distinct species in the sponges of commerce.

The animality of sponge is by no means universally admitted; indeed a considerable number of the naturalists of the present day regard it as of vegetable origin; and its position, in a natural classification of plants, it is said, should be between Algæ and Fungi.[2] But the recent observations of Mr. Bowerbank appear to me to be conclusive as to its animality. In one species of sponge he detected a branched vascular system, with globules in the vessels analogous to the circular blood disks of the higher animals. Nothing analogous to this has hitherto been detected in plants. The sponge derives its food from the fluid in which it lives. The water (containing the matters necessary for the existence of the animal) enters by the superficial pores, circulates through the anastomosing canals, and is expelled by the fæcal orifices or vents, carrying along with it particles which separate from the sides of the canals.[3]

Sponge adheres to rocks by a very broad base. When first taken out of the sea it has a strong fishy odour. Its colour varies from pale to deep brownish yellow. It often contains stony or earthy concretions (*lapides spongiarum*), which Bley[4] found to consist principally of the carbonates of lime and magnesia. Shells also are found in sponges. Various marine animals pierce and gnaw it into irregular holes.

Hab.—In the Red and Mediterranean Seas. Chiefly collected about the islands of the Grecian Archipelago.

COLLECTION.—The inhabitants of the Greek islands collect sponge by diving for it. In their submarine operations they carry with them a knife. Practice enables them to remain a considerable time under water.[5] As soon as the sponge is brought on shore, it is squeezed and washed to get rid of the gelatinous matters; otherwise putrefaction speedily ensues.

DESCRIPTION.—Commercial sponge (*spongia*) is the dry skeleton of the animal, from which the gelatinous flesh has been removed, as just mentioned. When deprived of stony concretions, &c., found in the interior of the mass, it is soft, light, flexible, and compressible. When burnt it evolves an animal odour. It absorbs water, and thereby swells up. Nitric acid colours it yellow. Liquor potassæ dissolves it: the solution forms a precipitate on the addition of an acid. The finer sponges, which have the greatest firmness and tenacity, were formerly called male sponge; while the coarser portions were denominated female sponge.

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[1] *Hist. des Polyp. Corall.* p. 20, 1816.

[2] See Hogg, in the *Linn. Trans.* vol. xviii. pp. 363 and 368; also, Johnson's *History of British Zoophytes*, ed. 1838.

[3] Grant, *Outlines of Comparative Anatomy*, p. 310, Lond. 1836.

[4] *Pharm. Central-Blatt für* 1834, S. 273.

[5] Savary, *Letters on Greece*, p. 109, Lond. 1788. [Dr. Lefevre, of Rochefort, found that among the Navarino sponge divers, accustomed as they were to the practice of diving, there was not one who could sustain entire submersion of the body for two consecutive minutes. The average period of entire submersion was seventy-six seconds.—ED.]

In 1841 duty (6d. per lb., with an additional 5 per cent. on the duty), was paid on 58,931 lbs. of sponge.

In English commerce[1] two kinds of sponge are met with, which are respectively known as Turkey and West Indian.

a. Turkey Sponge.—This is imported from Smyrna, and constitutes the best sponge of the shops. It occurs in cup-shaped masses of various sizes. Its texture is much finer than the West Indian kind. Mr. Bowerbank, by the aid of the microscope, has discovered that it consists of two species of Spongia, not distinguishable from each other by the naked eye. One of these is characterised by the presence of a beautiful, branched, vascular tissue, which surrounds, in great abundance, nearly every fibre of its structure, and is enclosed in an external membrane or sheath. In the other, and most common kind of Turkey sponge, no vascular tissue has yet been discovered. The common variety is called *honeycomb* sponge.

β. West Indian Sponge.—The principal source of this is the Bahama Islands; whence it is commonly known as *Bahama Sponge.* Its forms are more or less convex, with projecting lobes. Its fibre is coarser. Its tissue has but little cohesion, and hence this kind of sponge is commonly regarded as rotten. Mr. Bowerbank states that it consists of one species only of Spongia.

COMPOSITION.—Well washed sponge freed as much as possible from earths and salts by dilute acids, was analysed, in 1828, by Hornemann,[2] who found it to consist of a *substance similar to osmazone, animal mucus, fat oil, a substance soluble in water, a substance only soluble in potash, and traces of chloride of sodium, iodine, sulphur, phosphate of lime* (?), *silica, alumina, and magnesia.* Mr. Hatchett[3] found sponge to consist of *gelatine* (which it gradually gave out to water), and a thin, brittle, membranous substance, which possessed the properties of *coagulated albumen.*

According to the experiments of Posselt,[4] the substance of sponge is peculiar, and stands near the horny substance, from which, however, it is distinguished both in composition and properties. It, nevertheless, is not a proteine compound, nor does it contain a trace of such a body.

USES.—The extensive economical uses of sponge are familiar to every one. To the surgeon it is of great value on account of its softness, porosity, elasticity, and the facility with which it imbibes fluids. Its use at surgical operations and for checking hæmorrhage is well known.[5] It has also been applied to wounds and ulcers for imbibing acrid discharges.[6] The *sponge-tent* is usually made of compressed sponge impregnated with wax (*spongia cerata*), and which is called *prepared sponge* (*spongia preparata*). It is prepared by dipping sponge into melted wax, and compressing it between two iron plates till the wax hardens. It was formerly much used for dilating sinuses and small openings, but it is seldom resorted to now.

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[1] On the continent a considerable variety of sponges are known. See Baudrimont, in the *Dict. de l'Industrie*, t. iv. art. *Eponge*; and Dr. T. W. C. Martius's *Lehrbuch der pharmaceutischen Zoologie*, Stuttgart, 1838.

[2] *Berl. Jahrb.* Bd. xxx. Abt. ii.

[3] *Phil. Trans.* for 1800, p. 327.

[4] *Annalen der Chemie und Pharmacie*, Bd. xlv. Heft 2, p. 192, Feb. 1843.

[5] C. White, *An Account of the Topical Application of the Sponge in the Stoppage of Hæmorrhage*, Lond. 1762.

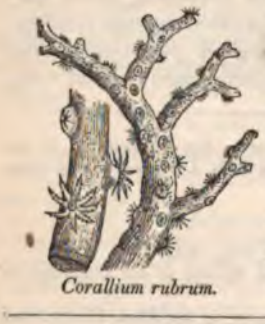
[6] *On the Use of Sponge after Amputations*, by Mr. T. Kirkland, in the *Med. Observ. and Inq.* vol. ii. p. 278, Lond. 1764.

[A patented material, under the name of *Spongio piline*, has been lately brought into professional notice for use in the application of fomentations, as a substitute for poultices, and for various other purposes. It is a kind of felted substance, varying in thickness, on a layer impermeable to water, and is capable of adapting itself readily to the part to which it is applied. Like sponge, it is fibrous and easily imbibes and retains water.—ED.]

SPONGIA USTA; *Pulvis spongiæ ustæ; Calcined* or *Burnt Sponge.*—Formerly in the Dublin Pharmacopœia, and directed to be prepared as follows:—Having cut sponge into pieces, beat it to free it from sand and stones; burn it in a closed iron vessel until it becomes black and friable, and reduce it to powder.—Preuss[1] calcined 1000 parts of sponge: of these, 343·848 parts were destroyed by heat. The residue consisted of *carbon* and *siliceous insoluble matters*, 327·0; *chloride of sodium*, 112·08; *sulphate of lime*, 16·430; *iodide of sodium*, 21·422; *bromide of magnesium*, 7·570; *carbonate of lime*, 103·2; *magnesia*, 4·73; *protoxide of iron*, 28·720; and *phosphate of lime*, 35·0.—Burnt sponge, if good, should evolve violet fumes (*vapour of iodine*) when heated with sulphuric acid in a flask. It has been employed as a resolvent in bronchocele and scrofulous enlargement of the lymphatic glands. Its efficacy is referable to the presence of iodine and bromine. Iodine is now almost invariably substituted for it.—Dose, ʒj. to ʒiij. It is given in the form of electuary or lozenges (*burnt sponge lozenges; trochisci spongiæ ustæ*). [A decoction of burnt sponge is, when filtered, colourless. When treated with starch and chlorine it strikes a blue colour, showing the presence of an iodide, probably of sodium, a salt also found in the oyster.—ED.]

Class II. Polypiphera, *Grant.* — Polypipherous Animals.

FIG. 113.



Corallium rubrum.

The polypipherous animals have received their name from the circumstance of their bearing tubes called *polypes*. They consist of two parts, a skeleton and a fleshy portion. The *skeletons* vary in their consistence, and also in their position relative to the soft parts. They are soft and flexible, or hard and calcareous. They are external and tubular, or internal and solid. The *fleshy portion* may be, with respect to the skeleton, either external or internal. It gives origin to fleshy tubes (*polypes*), each of which, at its external orifice, is surrounded by *tentacula*.

The calcareous internal skeleton of CORALLIUM RUBRUM, Lamarck (*Isis nobilis*, Pallas; *Gorgonia pretiosa*, Ellis), is the *Red Coral* of the shops. It consists of carbonate of lime principally coloured with oxide of iron. *Prepared Red Coral* (*Corallium rubrum præparatum*) was formerly used in medicine, but it presents no advantage over chalk. Its powder, obtained by levigation, or an imitation of it, is still kept in the shops, and is occasionally employed as a dentifrice. [According to Witting 100 grains of red coral yield the following constituents:—

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[1] *Pharm. Central-blatt für* 1837, 169.

Carbonate of lime	83·25
Carbonate of Magnesia	3·50
Oxide of iron	4·25
Animal gelatine and sand	7·75
Loss	1·25
	100·00 ED.]

SUBDIVISION II. RADIATA, *Lamarck.*—RADIATE ANIMALS.

CHARACTERS.—*Nervous system* distinct, composed of filaments and rudimentary ganglia; the filaments arranged circularly around the buccal orifice (*Cyclo-neura*).
No officinal substance is obtained from the Radiata.

SUBDIVISION III. MOLLUSCA, *Latreille.*—MOLLUSKS OR SOFT ANIMALS.

MALACOZOA, *Blainville.*—CYLO-GANGLIATA, *Grant.*

CHARACTERS.—Inarticulated animals with a soft not annulated *skin.* *Cerebral ganglia* arranged circularly around the œsophagus.

Class III. Conchifera, *Lamarck.*—Conchiferous Mollusks.

CHARACTERS.—Acephalous, aquatic mollusks, with a bivalve or a multivalve *shell.* *Organs of respiration* 4 pectinated laminæ. *Heart* simple. *Impregnation* effected without the assistance of a second individual.

371. OSTREA EDULIS, *Linn.*—COMMON EDIBLE OYSTER.

(The Shells burnt, of former *Ph. Lond.*)

HISTORY.—Oysters were greatly admired by the Romans as a most delicious article of food.[1] Those of Britain were much esteemed; though they were said to be inferior to those of Cyzicena (Pliny).[2]

ZOOLOGY. **Gen. Char.**—*Body* compressed, more or less orbicular. Edges of the *mantle* thick, non-adherent, or retractile, and provided with a double row of short and tentacular filaments. The two pair of *labial appendices* triangular and elongated. A subcentral bipartite *muscle.* *Shell* irregular, inequivalved, inequilateral, coarsely laminated. *Left* or

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[1] Pliny, *Hist. Nat.* lib. xxxii. cap. 6, ed. Valp.
[2] Juvenal, *Sat.* iv.

inferior valve adherent, largest, and deepest; its summit prolonged, by age, into a kind of keel. *Right* or *upper valve* smallest, more or less operculiform. *Minge* oral, toothless. *Ligament* somewhat internal, short, inserted in a cardinal pit, growing with the summit. The *muscular impression* unique and sub-central (Blainville).

Sp. Char.—*Valves* ovate-roundish or obovate; the upper one flat. *Lamellæ* of both valves imbricated and undulated (Brandt).[1]

Brandt[2] has given an elaborate account of the anatomy of the oyster, to which I must refer the student interested in these details.

Hab.—European and Indian seas. Our own coasts furnish some of the finest kinds.

OYSTER FISHERIES.—Oysters are caught by dredging. In order to improve their flavour and size they are laid on beds in creeks along shore, where they rapidly improve. Colchester and other places of Essex, as well as some parts of the coast of Kent, are the nurseries or feeding grounds for the metropolis.[3]

DESCRIPTION.—The officinal parts of oysters are the *shells* (*testæ ostreæ*). The hollow halves are preferred as they contain more carbonate of lime. When calcined, oyster shell yields a quicklime formerly much esteemed as a lithontriptic.[4]

COMPOSITION.—*Oyster shells* have been analysed by Bucholz and Brandes,[5] and by Rogers.[6]—The *flesh of the oyster* has been analysed by Pasquier.[7]

Bucholz and Brandes's Analysis.

Carbonate of lime	98·6
Phosphate of lime	1·2
Alumina	0·2
Albuminous matter	0·5
Oyster Shells	100·5

Pasquier's Analysis.

Osmazome Gelatine Mucus Albumen Fibrine	12·6
Water	87·4
Flesh of the Oyster	100·0

[The ashes yield iodide of sodium.—ED.]

The dietetical properties of oysters have been before noticed.

TESTÆ PRÆPARATÆ; *Testæ Ostrearum Præparatæ; Prepared Oyster Shells* of former *London Pharmacopœia.*—Wash the shells, first freed from impurities, with boiling water; then prepare in the same manner as directed for chalk.—The mode of preparing chalk by elutriation has been already described. After oyster shells have been washed, boiled, and crushed, they are dried and ground to an impalpable powder previous to elutriation. In the shops the substance sold as prepared oyster shells is in small conical masses. The principal constituent of prepared oyster shells is carbonate of lime, and they therefore possess the same medicinal properties as chalk, already described, and which is usually substituted for them.

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[1] *Med. Zool.*

[2] *Ibid.* Bd. ii.

[3] For details respecting the treatment of oysters in beds, see Spratt's *History of the Royal Society*, p. 307. "In the fish-shops, the oysters are laid with their flat sides uppermost; they would die were it otherwise. The animal breathes and feeds by opening its shell, and thereby receiving a new portion of water into the concavity of its undershell. Oysters, when packed in barrels, should be laid in the same position. Geologists can tell whether oysters were overwhelmed in their native beds, or rolled away and scattered as shells, by determining their position." (Paley's *Theology*, by Bell, vol. ii. pp. 220–221.)

[4] [Mrs. Stephens' remedy for the stone consisted of the calcined shells of eggs and snails. Oyster-shells would have been just as efficacious! She received a reward for an apparent cure in one case, on the condition that she published the formula. After the death of the patient, the stone was found encysted in the bladder!—ED.]

[5] Gmelin, *Handb. d. Chem.* ii. 1477.

[6] *Silliman's Journal*, vol. xxvi. p. 361.

[7] Gmelin, *op. supra cit.*

Class IV. Cephalopoda, *Cuvier.*—Cephalopods.

CHARACTERS.—*Body* inclosed in a bag (*mantle*). *Head* protruding from the bag, crowned with inarticulated arms, furnished with cups or suckers, and surrounding the mouth. *Eyes* two, sessile. *Mouth* with two horny mandibles. *Hearts* three. *Sexes* separate.

372. SEPIA OFFICINALIS, *Linn.*—COMMON CUTTLE-FISH.

The substance called *os sepiæ* or *cuttle-fish bone* is an oval or oblong calcareous bone (sometimes termed a *shell*) deposited in the mantle of the animal. The common species of sepia is *S. officinalis*, Linn.; but *S. elegans*, Blainville, also yields part of the cuttle-fish bone of the shops.[1]

Os sepiæ has a cellular texture, and is so light as to float on water. It is cast in considerable quantities on the shore, and is collected for commercial purposes. It was analysed by John, who found the constituents to be as follows:—

	Hard Upper or Outer Portion.	*Porous Part.*
Carbonate (with a trace of phosphate) of lime	80	85
Non-Gelatinous animal matter, soluble in water with some common salt.	7	7
Gelatinous membrane not soluble in water	9	4
Water, with a trace of magnesia	4	4
	100	100

Reduced to powder, it is used as a dentifrice. It is employed for several purposes in the arts, as for polishing, for forming moulds for small silver castings, and as a pounce.

SUBDIVISION IV. ARTICULATA, *Cuvier.*—ARTICULATED ANIMALS.

CHARACTERS.—*Skin* annulated. *Muscles* attached to the inner surface of the skin. *Nervous system* of two cords extended along the ventral surface of the body, with ganglionic enlargements at intervals (*diplo-neura*); the anterior ganglion (brain) placed over the œsophagus.

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[1] Brandt and Ratzeburg, *Med. Zoolog.* ii. 599.

Class V. Annulosa, *Macleay.*—Annulose Animals.

ANNELIDES seu ANNELIDA.

CHARACTERS.—*Body* more or less elongated. *Skin* soft, segmented and annulated. *Articulated members* and *wings* absent. *Blood* red.

373. SANGUISUGA, *Savigny.*—BLOOD-SUCKING LEECHES.

Iatrobdella, *Blainville.*

HISTORY.—We have no accurate knowledge of the exact period when leeches either became known to, or were employed by, man; but this deficiency of information is not necessarily referable to their discovery preceding the date of our historical documents. It is true that in the common version of our most ancient record, the Bible,[1] this passage occurs, "The horse-leech hath two daughters, crying, give, give;" but critics are not agreed as to the correctness of this translation. The word "*Olukeh*," or "*Aluka*," here interpreted "*horse-leech*," means, according to Bochart, destiny or fate, either of which terms should, according to this writer, be substituted for that of horse-leech; the daughters alluded to being Eden and Hell. But the Vulgate, Greek, and Lutheran translations, are all against his opinion. Brandt[2] has entered into a very elaborate discussion of this subject, from which it appears that, in Arabic, the term *Aluka* indicates a leech, while *Aluk* signifies fate; the latter being derived from *Alaka*, to attach or hang to, because every man's fate is supposed to be appended to him, just as a leech affixes itself to the body; so that from this it appears probable the word "*Olukeh*" of the Old Testament really refers to the leeches. Nay, I think there is some reason for suspecting that the *Sanguisuga ægyptiaca* is the species referred to. The leeches referred to by Herodotus[3] are *Bdella nilotica* (Savigny).

But admitting that these animals were known at this early period, it does not appear that they were employed in medicine: for Hippocrates makes no mention of them, although he notices other modes of drawing blood. Aristotle also is silent with regard to them. In the extracts which Cælius Aurelianus has made from the writings of Diocles, Praxagoras, Herophilus, Heraclides, Asclepiades, and other ancient physicians, who lived between the time of Hippocrates and Themison, no mention is made of the employment of leeches; a remarkable fact in favour of the opinion that they were not at this period in use. In fact, the founder of the Methodic sect, Themison, is the first person in whose works we find mention of leeches being employed therapeutically.[4] However, it does not follow that he was the first who prescribed them, though our documentary evidence fails in tracing back their use beyond his time.

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[1] *Prov.* xxx. 15.

[2] *Med. Zool.* ii. 231.

[3] *Euterpe*, lxviii.

[4] Le Clerc, *Hist. de la Méd.* p. 442, nouv. éd. 1729.

In the Latin and Greek languages, the animal has received its name from its sucking or drawing qualities. Thus the Greeks called it *βδέλλα*, from *βδέλλω*, to suck; the Romans *hirudo*, probably from *haurio*, to draw out; or *sanguisuga*, literally signifying "blood-sucker," from *sanguis* and *sugo*. It would appear, however, that the latter of these two Latin terms is the more modern; for Pliny,[1] in speaking of elephants, says "Cruciatum in potu maximum sentiunt, hausta, hirudine, quam sanguisugam vulgo cœpisse appellari adverto."

ZOOLOGY. **Gen. Char.**—*Jaws* with two rows of pointed, numerous *teeth*, which are mutually inclined at an acute angle (Brandt).[2]

Body elongated. *Back* convex. *Belly* flat. *Extremities* somewhat narrowed, furnished with disks or suckers; the anterior extremity somewhat narrower than the posterior one. *Rings* from ninety to a hundred. *Eyes* represented by ten blackish points. *Mouth* tri-radiate. *Jaws* cartilaginous, armed with numerous cutting teeth. *Anus* small, placed on the dorsum of the last ring.

Cuvier[3] includes all leeches in the genus *Hirudo*; but later naturalists have found it necessary to arrange them in several genera. The leeches employed in medicine have been formed into a distinct genus, called by Blainville[4] *Iatrobdella* (from ἰατρὸς and βδέλλα, *a leech*), by Savigny,[5] *Sanguisuga*. The latter classical term, so expressive of the blood-sucking properties of the genus, I have adopted. All leeches, it appears, are not provided with an apparatus for perforating the skin of vertebrate animals. In consequence of the numerous complaints addressed to the Préfet de Police, in 1825, that of the leeches sold in Paris some would not bite, while others caused painful and obstinate wounds, he consulted the council de Salubrité, who deputed MM. Pelletier and Huzard fils, to inquire into the accuracy of the statements. One of the results of the investigation was, that the animal called in France *horse-leech*, and which had been particularly charged with causing painful wounds, could not perforate the human skin, the teeth of the animal being quite blunt.[6] The horse-leech referred to, the reporters declared to be *Hæmopis sanguisorba*, Savigny; but Blainville says it was *Hæmopis nigra*.

Species.—1. SANGUISUGA MEDICINALIS, Savigny, L.; *Hirudo provincialis*, Carena, Mem. della Reale Accad. di Torino, xxv. 282; *Sanguisuga meridionalis*, Risso, Hist. Nat. de l'Europe mérid. t. iv. p. 428; *the Green Leech.*—*Back* greenish or blackish-green, with six rusty-red band-like [longitudinal] stripes. *Belly* olive-green, unspotted (Brandt).—South of Europe. Those brought to England come from Bordeaux, Lisbon, and Hamburgh.

Moquin-Tandon[7] admits three varieties:—

α. Dorsal bands interrupted at intervals.
β. Dorsal bands reduced to blackish spots.
γ. Dorsal bands united by transverse ones.

2. SANGUISUGA OFFICINALIS, Savigny; *Hirudo medicinalis*, Linn. L. D.; *True English* or *Speckled Leech.*—*Back* greenish or olive-green, with six rusty red longitudinal stripes, which are mostly spotted with

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[1] *Hist. Nat.* viii. 10, ed. Valp.
[2] *Med. Zool.* ii. 231.
[3] *Règne Animal*, nouv. éd. t. iii. p. 212, 1830.
[4] *Dict. des Scien. Nat.* t. xlvii. art. *Sangsue.*
[5] *Desc. de l'Egypte, Hist. Nat.* t. i. part. iii. p. 114.
[6] *Journ. de Pharm.* t. xi.
[7] *Monogr. de la fam. des Hirud.* p. 112.

black. *Belly* greenish yellow, spotted with black (Brandt).—*Spots* very variable in size and number; in some cases they are but few; in others are so numerous as to form the almost prevailing tint of the belly, the intervening spaces appearing like greenish yellow spots.—Europe, especially the northern parts. A native of England, but rare. Imported from Hamburgh.

Several varieties of this leech have been described and figured. One of the most remarkable of these is the *flesh coloured medicinal leech* (*Sanguisuga medicinalis carnea*) described by Guillez of Paris. The anterior half of its body is flesh-coloured; while the posterior half is of the usual colour. The *spotted* or *piebald leech* is flesh-coloured, with olive-green spots.[1]

These are the only species employed in medicine in this country. Others have been described and figured by Brandt.[2] The following is a short sketch of the *anatomy* of the medicinal leech:—

The Cutaneous System of the animal consists of a transparent *epidermis* (which is thrown off from the body every four or five days) and the *corium*. The latter consists of condensed cellular tissue, composed, according to Brandt, of globules. Like the epidermis, it shows the partitions into rings. It contains a number of *globules* impregnated with a pigment varying in colour in different places, and which is the source of the colours presented by the surface of the animal.

It is asserted that the predominant or base colour is, in part at least, owing to the colour of the soil in which the animals are found. Dr. J. R. Johnson[3] says, "Mr. Baker, a man of some intelligence, residing in Glastonbury, and who for the last twenty years has been in the habit of collecting large quantities of leeches for sale, informs me that at the Black River, near Glastonbury, they are black, from the peat being of that colour; at Cook's Corner, they are of a reddish cast, from the red peat; while at Auler Moor, where, from a deficiency of peat, they penetrate the clay, they are yellow."

The Muscular System has been elaborately described by Brandt, but can scarcely be comprehended without the aid of drawings. The muscles of the trunk are arranged circularly, longitudinally, and obliquely: of these the circular fibres are the most external, and the longitudinal ones the most internal.

The Digestive System consists of a mouth, alimentary tube, anus, salivary glands, and liver. The *mouth* is placed in the middle of the oval or buccal disk; its shape is triradiate,—that is, of three equidistant lines or rays meeting in a centre. Within it are three white sublenticular *jaws* (*dentiferous tubercles* or *piercers*), which in appearance are cartilaginous; but Brandt says they consist of a strong firm skin, inclosing a muscular mass. On the free-curved sharp margin of each jaw are about sixty small finely-pointed *teeth*. The *œsophagus* is a muscular tube, and dilates as it approaches the stomach; but at its termination it contracts into a small circular aperture, its whole length not exceeding a quarter of an inch. The *stomach* occupies two-thirds of the length of the animal, and is divided into about eleven compartments or cells, each of which, from the second to the eleventh, gives off on each side a *cæcal sac*, those of the last cell being by far the largest, and extending down by the side of the intestine as far as the commencement of the rectum. The stomach consists of three coats,—a cellular, a muscular, and a mucous coat. Its eleventh cell terminates by a funnel-shaped projection in the intestine. The *intestine* is about an inch in length; at its upper orifice is a valve, and at its lower end a sphincter; on either side of it, for the greater part of its length, is one of the sacs for the last compartment of the stomach; on its inner surface are several folds. It is divided into *small* and *large intestine*, the lower part of the latter being called a *rectum*. The *anus* is not, as we might anticipate, in the posterior disk, but on the dorsal surface of the last ring. *Salivary organs* have been described: they consist of whitish granular masses placed around the œsophagus, into which tube the common salivary duct opens. De Blainville, Carus, and Brandt, speak of a *liver*. It is a brownish mass placed on the alimentary canal, the ducts opening into the stomach and intestine. The best mode of displaying the cells of the stomach is to immerse a leech, fully gorged with blood, for a week in a saturated solution of corrosive sublimate.

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[1] See Brandt and Ratzeburg, *Med. Zool.*

[2] *Med. Zool.* ii.

[3] *Treat. on the Med. Leech*, p. 42, 1816.

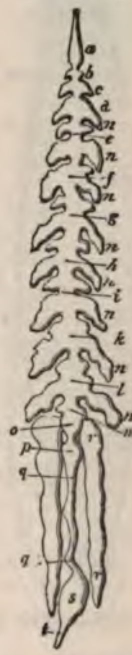
The **VASCULAR SYSTEM** consists of four great pulsating *vessels*, giving off numerous ramifying branches; but without any heart, commonly so called. Two of these are placed laterally, a third in the median line of the dorsal surface, and a fourth on the abdominal surface. All these vessels pulsate (Johnson). We know very little about the manner in which the blood circulates. Brandt thinks that the lateral vessels must be arteries, on account of their very distinct transverse and longitudinal fibres: the dorsal and venous vessels he terms veins.[1] Does not the dorsal vessel correspond to the vena cava, and the abdominal vessel to the vena porta, of higher animals? Grant,[2] however, terms the dorsal vessel of the annelides an artery.[3]

THE RESPIRATORY SYSTEM consists of small apertures (called *stigmata* or *spiracula*) arranged in two rows on the abdominal surface, and occurring at every fifth ring. They lead into little cavities lined by mucous membrane, and which have been called *air sacs*, *pulmonary vesicles*, *mucous bags*, *cryptæ*, or *lateral vesicles*, containing usually a whitish fluid. They are placed on each side of the alimentary canal, in the spaces between the cæcal sacs of the stomach, and are usually regarded as organs of respiration. Brandt, however, asserts that the respiratory function is effected solely by the skin, and that these vesicles are, in fact, receptacles for mucus secreted by a neighbouring *glandular apparatus*, which has a whitish appearance, and in form represents a folded intestine. This notion, however, is not new, but was held by De Blainville and Johnson.

The **NERVOUS SYSTEM** consists of two parts: *one* (which we may compare to the *cerebro-spinal axis* of the vertebrata) consists of a chain of ganglia (usually about twenty-three in number) occupying the mesial line of the abdomen, and connected by a double nervous cord; the first ganglion (*brain*) is placed on the œsophagus, and supplies the eyes and neighbouring muscles. The *second* part of the nervous system is that lately discovered by Brandt, and may be regarded as a kind of *sympathetic system*. It consists of three ganglia (connected to the brain by filaments, and supplying the jaws), and a single nerve connected to them, and running along the abdominal surface of the stomach in the mesial line.

Of the **EXTERNAL SENSES** three only have been recognised: *feeling*, which resides in the external surface of the body; *taste*, apparently indicated by the fondness of leeches for certain fluids (as blood, milk, &c.); and *vision*, effected by ten eyes (in the form of black spots) arranged in a crescent form at the anterior or cephalic extremity of the animal.

FIG. 114.



Alimentary Canal of the Leech.

a, Œsophagus.
b, c, d, e, f, g, h, i, k, l, m, Cells of the stomach.
n, Cæcal sacs.
o, Funnel-shaped pylorus.
p, Irregularly expanded commencement of (*q*) the small intestine.
r, Cæcal sac of the last cell of the stomach.
s, Large intestine.
t, Rectum.

The **SEXUAL SYSTEM** is double,—that is, each animal is androgynous, or possesses both male and female organs. There is, however, no power of self-impregnation (the contact of two individuals being requisite, each acting to the other in a double capacity of male and female). The *MALE ORGANS* consist of several pairs of *testicles*,

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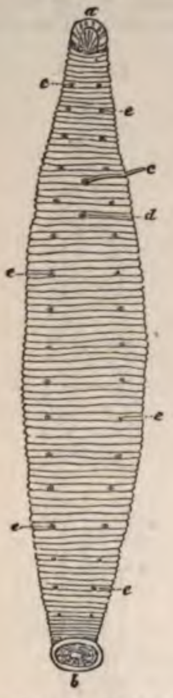
[1] *Med. Zool.* t. ii. 249.

[2] *Outl. of Comp. Anat.* 440.

[3] Some interesting observations on the vascular system of leeches are contained in Knolz's *Nat. Abhandl. üb. d. Blutegel*, Wien, 1820.

two vasa deferentia, two vesiculæ seminales, two ejaculatory ducts, and a *penis* surrounded at its base by what some have termed a *prostate gland.* The penis projects from the abdominal surface at about one-third distant from the anterior extremity. The *FEMALE ORGANS* consist of *two ovaries, two oviducts* (which subsequently unite into one) a hollow organ (*uterus*) which opens by a contracted aperture (*vagina*) externally at about the twenty-ninth ring, or five rings below the penis.

FIG. 115.



Ventral Surface of the Leech.

a, Anterior disk.
b, Posterior disk.
c, Penis.
d, Vaginal orifice.
e, Stigmata.

That leeches are essentially oviparous admits of no doubt; and we have now an admirable account of their development by Professor Weber.[1] It appears that soon after copulation an unusual activity pervades the ovaries, in consequence of which some *ova* (termed by Weber *germs*, by Carus *yelks*) are separated, and pass along the oviduct to the uterus, where they stop, in order to obtain the matters necessary for their development, and their proper coats. They here become invested with a serous-like membrane, on the inner side of which is produced (either by secretion from the uterine cavity or from the membrane itself) an albuminous whitish mucus, serving in part for the nourishment of the ova, and which is regarded as a kind of *liquor amnii.* Subsequently a glutinous fluid is deposited on the outside of the serous coat. When the ova are expelled from the uterus, part of this fluid gives a coating to them, while part is expelled before and after them. But this coat seems now distended with air-vesicles, and has the frothy appearance of well-beaten white of egg, produced by the violent contraction of the uterus.

The animals usually deposit their ova (in their own native waters) in holes or moist places on the shore, from May to the end of September. When first expelled, they are somewhat cylindrical in form, and have a brownish appearance. The frothy layer adheres very slightly; but after lying in the water for a quarter of an hour the outer surface becomes somewhat hardened, forming a kind of pellicle or fine skin. After some days a portion of this frothy covering is converted into a spongy tissue (*spongy coat of the cocoon*), covering the capsule of the ova (*cocoon*) wholly or partially. In this state the cocoon has a brownish, fibrous appearance, similar to fine sponge, and varies somewhat in its size and weight; its longest diameter being from six to twelve lines, its shortest from five to eight, and its weight from twenty-four to twenty-eight grains.[2]

The ova or germs, which have a lenticular form, evince vital movements; and very soon we perceive on each a funnel-shaped tube, extending from their surface inwards, and which appears to absorb the albumen of the cocoon. The ovum goes on enlarging, and becomes somewhat elongated, and subsequently the young leech begins to be developed on the exterior part of the ovum, the aperture of the funnel being the spot where the mouth of the young animal is observed. The abdominal surface is the first, the dorsal the last to be developed. When the young leeches have attained a considerable size they pierce their cocoon.

DISEASES OF LEECHES.—The natural duration of the life of leeches is not easily determined; but judging from the slowness of their growth, and the length of time full-grown leeches have been preserved, we may necessarily infer that they are long-lived animals. Dr. Johnson thinks that in their native waters, if they can always meet with an abundant supply of food, they may live at least twenty years. But they are subject to several diseases, some of which are epidemic, and of a very destructive kind. Although the study of the pathology of this animal is of considerable interest in a commercial and even scientific point of view, yet no practically useful results have hitherto been arrived at, in regard to the prevention and treatment of the diseases of leeches. Dr. J. R. Johnson mentions three diseases as common to this animal:—1st. An ulcer, seated in various parts of the body, but more generally affecting the side. It destroys life in a few days. 2ndly. A rigidity and narrowing of one part, whilst another portion is studded with tumours of putrid coagulated blood. 3dly. A flaccid appearance of the whole body, except the lips, which are hard, swollen, purple, and frequently bloody. These diseases are particularly prevalent during the summer months. Brostat[1] describes three epidemic disorders.

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[1] Meckel's *Archiv*, for 1828, p. 366.

[2] See figures of the cocoon, in Dr. J. R. Johnson's *Further Observations on the Medicinal Leech*, 1825.

COLLECTION AND COMMERCE OF LEECHES.—Leeches may be caught with the hand, or by a kind of net (described by Derheims), or by the gatherers going into the ponds with naked feet, to which the leeches adhere; or by baits, especially the liver of animals. The two latter methods are objectionable,—one because it is not free from danger to the gatherers, and the other because it is apt to injure the health of the animal. An interesting and graphic account of the leech fishery at La Brenne, and of the miserable appearance of the fisherman who collects the leeches, by allowing them to attach themselves to his legs and feet, has been published in the *Gazette des Hôpitaux*. A translation of this paper is given in M'Culloch's *Dictionary of Commerce*. Leeches are largely imported from Hamburgh. The Hamburgh dealers draw their supplies from the Ukraine. "Having exhausted all the lakes of Siberia, Bohemia, and other more frequented parts of Europe, the buyers are now rolling gradually and implacably eastward, carrying death and desolation among the leeches in their course—sweeping all before them, till now they have got as far as Pultava, the pools and swamps about which are yielding them great captures."[2] Leeches are

FIG. 116.

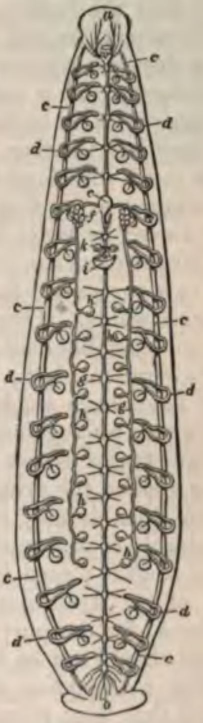

Diagram illustrative of the internal anatomy of the leech.

a, Brain.
b, Last ganglion.
Between these will be observed the chain of ganglia of which they form portions.
c, Lateral or branchial vessels.
d, Folded mucous glands; each is connected by a duct to an air vesicle.
e, Penis, the rounded enlarged base of which is supposed to contain the prostate gland.
f, Vesiculæ seminales.
g, Vasa deferentia.
h, Testicles.
i, Uterus.
k, Ovaries.

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[1] Brandes's *Archiv*, Bd. v.

[2] Bremner, *Excurs. in the Interior of Russia*, vol. ii. p. 408, 1839. [In some parts of England, more particularly in the fenny districts of Cambridgeshire and Lincolnshire, the

sometimes imported in bags, but more frequently in small barrels, each holding about 2000, the head being made of stout canvas to admit the air. The best vessels for preserving these animals are unglazed brown pans or wooden tubs. The dealers have a notion (and possibly a correct one) that the leaden glazing is injurious. These pans should be very little more than half filled with soft water (pond, river, or rain water). This does not require changing so often as is commonly supposed. [The introduction of a small quantity of salt into the water during warm weather is stated to have been found efficacious in preserving them.—Ed.] In very hot weather, or when the water has become bloody, or otherwise much discoloured, it should be changed every day or so; otherwise, in summer every four or five days, or a week; in winter, once a month is believed by large dealers to be sufficient.

[Preservation of Leeches.—The very general use of aquaria has led to a suggestion for preserving leeches with a proper regard to their natural wants. They have been taken from pools and swamps abounding in vegetable matter which maintains the water in a proper condition as to aëration,—the vegetable being compensatory of the animal life,—and have been suddenly transferred to pond or river water in which there was no vegetation. That they should frequently die under these circumstances is not at all surprising. Mr. Hibberd and Mr. Allchin have applied the principle of the aquarium to these useful animals; and *Leech-Aquaria* may now be had which are said to answer the purpose admirably of preventing mortality among leeches. Well-washed coarse river sand is placed in the vessel with a few roots of *Vallisneria spiralis* and of the *Anacharis*. A few water-snails (*Plenorbis Corneus*) are introduced for the purpose of consuming decayed vegetable matter. The vessel should not be kept in too strong a light.[1]—Ed.]

The *consumption of leeches* is enormous. Some years ago it was stated that four principal dealers in London imported, on the average, 600,000 monthly, or 7,200,000 annually.[2] Feé[3] says, "it is estimated that 3,000,000 are annually consumed in Paris; and as the population of Paris is to that of the whole of France as one is to thirty-three, it follows that, independently of exportation, 100,000,000 are consumed annually, which is equivalent to three leeches annually for each person. Now, if we estimate the average price at fifty francs per thousand, we shall have the enormous sum of five millions of francs paid for this one article of our materia medica."

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trade in leeches forms a valuable branch of business. The manner in which the leeches are taken is this:—Two or three persons, furnished with long poles, enter the marshes with their shoes and stockings off, and continue beating the weeds and rushes for some time. The leeches being disturbed by this proceeding are aroused from their wonted lethargy, and impelled by hunger, the effect of long abstinence, seize with avidity the first animal object they meet with. The feet and ankles of the leech-catchers being exposed to them, the same are freely fastened upon by the leeches, and they are thence removed and deposited in a basket carried for the purpose of receiving them. When taken home they are washed in a weak solution of salt and water, and when purified are carefully packed in wet linen cloths. In this manner they are dispatched to the different leech merchants and the various medical establishments throughout the country.]

[1] *Pharmaceutical Journal*, vol. xv.

[2] Price, *Treat. on Sanguisuct.* p. 129, 1822.

[3] *Cours d'Hist. Nat.* t. i. p. 21.

[The editor of a French journal states that the monopoly of leeches in Morocco was ceded by the Emperor to M. Rey in 1846 for a sum of 15,000 francs. The trade was so profitable that in 1854-5 a sum of 350,000 francs was paid by a native company to whom the exclusive trade in leeches was granted. The great seat of export of this company is at Tangier. The annual exports are stated to amount to about fifteen millions of leeches — the greater part being sent to France. Some go to Spain, others to England: but as the Morocco trade is chiefly in green leeches, while in England the black leeches are preferred, this country receives comparatively but few from that source. They are exported in boxes filled with clay, each box containing 5000 leeches. The green leeches fetch ten piastres per thousand weighing about one pound; the black at from twelve to fourteen piastres per thousand.[1] — ED.]

[Dr. Berard states that France imports yearly from Sardinia, Italy, and Spain leeches to the value of nearly three millions of francs, and they are imported into these countries from other localities. Numerous trials have been made for the artificial propagation of leeches, but these attempts have not been successful to any practical extent. The young which had been produced disappeared so that after a few years, only those remained with which the propagating ponds had been originally stocked. Dr. Berard gives a long list of the enemies of the leech for which we must refer the reader to his paper on the subject.[2] From the report of a Commission recently published,[3] it appears that hirudiculture has been successfully prosecuted by MM. Bechade, on the marsh-land in the Gironde, and that, commencing in 1835, they have at the present time succeeded in creating out of this branch of industry a profitable and useful speculation. We must refer the reader to the report for much curious information on this subject: but the great secret of success appears to have consisted in supplying proper food to these animals. There is a large establishment of horses, asses, and cows for the purpose of feeding the leeches. They are driven into the ponds at certain times, and thus furnish blood to the leeches. The reporters state that the horses, which die annually as a result of these hirudicultural practices, amount to from 700 to 750! Yet it is said to be a profitable speculation. — ED.]

MODE OF BITING.—Having fixed on a suitable spot, the animal applies its oval disk, and firmly fixes it (at first, perhaps by atmospheric pressure; then by intimate contact), so that the anterior end forms an angle with the other portions of the body. The three cartilaginous jaws bearing the sharp teeth are now stiffened and protruded through the tri-radiate mouth against the skin, which they perforate, not at once, but gradually, by a saw-like motion. Dr. Johnson[4] says, "The jaws are carried from side to side in an oblique direction;" and adds, "their action may be seen by presenting to the leech a coagulum of blood, and when the leech is in the act of suction, cautiously removing it. For a few seconds it appears unconscious of its removal, which presents a fair opportunity of observing the oscillatory movement of each piercer." The wound is not produced instantaneously, for the gnawing pain continues for two or three minutes after the animal has commenced operations. Thus, then, it appears that the leech saws the skin; hence the irritation and inflammation frequently produced around the orifices. The flow of blood is promoted by the suction of the animal, which swallows the fluid as fast as it is evolved. During the whole of the operation the jaws remain lodged in the skin. In proportion as the anterior cells of the stomach become filled, the blood passes into the posterior ones; and when the whole of this viscus is distended, the animal falls off. On examination it will be found that not a particle of blood has passed into the intestine.

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[1] [*Journal de Chimie Médicale*, 1855, p. 679.]

[2] [*Pharmaceutical Journal*, vol. xi. p. 39.]

[3] [*Journal de Chimie Médicale*, 1856, p. 174.]

[4] *Treat.* p. 112.

PHYSIOLOGICAL EFFECTS.—There are two classes of phenomena observed in all modes of drawing blood; one of which has been termed *local*, the other *general*. In phlebotomy and arteriotomy, the first is trifling, and of no therapeutic value; and we resort to these operations only as means of affecting the general system. On the other hand, we obtain topical effects, both powerful and useful, from cupping and leeching; hence these are termed *local*, while the former are denominated *general* blood-lettings. It must, however, be remembered, that constitutional or general effects are also frequently obtained from both cupping and leeching.

1. *Constitutional or general effects of leeching* are the same in kind as those caused by the loss of blood from other means. A moderate quantity of blood may be abstracted without any obvious effects on any of the functions; but, if the amount taken be increased, syncope results. The quantity necessary to produce this effect varies, however, considerably, and will depend on the mode of drawing it (whether rapidly or otherwise); the position, constitution, and age of the patient; the nature of the disease; and many other circumstances not necessary to enumerate. It is well known that a small quantity will, if taken rapidly, and the patient be in the erect posture, cause this result; whereas a considerably larger amount may be abstracted, if taken gradually, and the patient be in the recumbent position, without giving rise to it. The usual explanation of this is, that when blood is drawn faster than the vessels can contract, the circulation is temporarily stopped and fainting ensues. Several reasons, however, lead me to doubt the sufficiency of this explanation. Leeching, then, as being a slower mode of extracting blood, is less likely to cause syncope than venesection, or even cupping. As the patient recovers from the fainting state, hysterical symptoms sometimes manifest themselves. Throbbing headache, and sleeplessness, are by no means uncommon consequences of loss of blood. In some cases I have seen febrile excitement, of several hours' duration, brought on by blood-letting.[1]

Dr. Marshall Hall[2] has directed attention to the disorder of the cerebral functions (marked by convulsions, delirium, or coma) caused by blood-letting. I may observe, that convulsive movements are by no means uncommon in syncope from general blood-letting, and I think are not always to be considered as denoting that the remedy has been used beyond the safe degree. I have on several occasions been told by patients about to lose blood, that they are apt to faint and struggle when bled; and I have, in consequence, been requested to prevent them from injuring themselves. Delirium and coma are less frequently met with. Great depression of the vascular system, followed by sudden dissolution, is another occasional effect of loss of blood.[1]

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[1] For further details respecting the effects of loss of blood, see Dr. Clutterbuck *On the proper Administration of Blood-letting*, 1840.

[2] *On the Morbid and Curative Effects of Loss of Blood*, 1830.

As might be expected, an operation so powerfully affecting the vital functions cannot be passive in its influence over morbid action; but the phenomena vary so much in different diseases; and even in the same disease under different circumstances, that it becomes extremely difficult to offer any general results. That loss of blood is sometimes beneficial, at other times hurtful, is well known. Its immediate beneficial effects are best seen in pneumonia and ophthalmia. In the first of these diseases the respiration sometimes becomes easier, and the pain removed, while the blood is flowing; and from this time the amendment progresses. In ophthalmia, the redness of the conjunctiva disappears during the syncope from blood-letting, and sometimes never returns with equal intensity. A tendency to hemorrhage has been thought by some experienced practitioners to be engendered or increased by the application of leeches. Thus the return of the menses, the aggravation of menorrhagia, hæmoptysis, and apoplexy, have been found to follow, and apparently to result from, the employment of leeches.[2] The effects of blood-letting are considerably influenced by disease. Every practitioner is acquainted with the fact, that in certain morbid conditions patients bear the loss of larger quantities of blood than in others. I need only mention apoplexy, inflammation of the serous membranes, peripneumony, and phrenitis, as examples of increased tolerance; while chlorosis and cholera may be cited as instances of diminished tolerance. On this point there cannot be, I think, two opinions.

I am not prepared to assent to the inferences Dr. Hall has drawn from these facts, nor to the rules he has laid down in the diagnosis and treatment of disease founded on the circumstances just mentioned. The susceptibility to syncope is so great in some persons, that we should, I suspect, be often led into error, if we were to infer the absence of inflammation merely from the occurrence of fainting after the loss of a few ounces of blood. Besides, it not unfrequently happens that a patient faints on the first, but not on the second or third bleeding. I have more than once seen this. Neither do I think it would always be safe to bleed *ad deliquium*, even if we were satisfied that inflammation was present; for in some it is difficult to occasion syncope, although the quantity of blood lost be so great as to endanger the safety of the patient. The practice of Dr. Hall, however, is much to be preferred in this respect to that of Mr. Wardrop;[3] for, although both recommend bleeding to syncope in inflammation, the former places his patient in the erect, the latter in the recumbent posture. And here I cannot help remarking, that the practice of ordering patients to be bled to syncope in the recumbent posture appears to me a highly dangerous one. That fainting will sometimes occur in the erect position, before a sufficient quantity of blood has been drawn, we all know; and, to prevent this occurrence, it is frequently proper to bleed in the recumbent posture: but I must protest against bleeding patients to *syncope* in this position.

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[1] See an illustrative case in the *Lancet*, vol. xi. p. 94.

[2] See the observations of Laennec and Sir James Clark, in Forbes's translation of Laennec's *Treatise on Diseases of the Chest*, p. 193, 1827.

[3] *On Blood-letting.*

I have yet to notice another class of the general effects of the loss of blood, which may be denominated secondary or remote, and which are in no way useful in the treatment of disease. In some cases excessive reaction occurs, attended with throbbing of the vessels of the brain, pain and disorder of the cerebral functions. Examples of this are seen in women who have suffered severely from uterine hemorrhage. Exhaustion, with insufficient reaction, is another remote effect of loss of blood. In two cases of infants, I have seen this effect, consequent on hemorrhage after a leech-bite, terminate fatally. Other secondary or remote effects of blood-letting are mentioned: they consist principally in disorder of the sensorial functions, marked by delirium, coma, or even amaurosis.[1]

Having hitherto described the consequences of bleeding generally, I must now refer more particularly to *leeching*. The constitutional or general effects caused by the application of leeches are best observed in children and delicate females—more especially the former. I have, on several occasions, seen infants completely blanched by the application of one or two leeches. Pelletan mentions the case of a child, six years old, who died from the hemorrhage occasioned by six leeches applied to the chest. Leeching, then, is here, to all intents and purposes, a mode of general blood-letting, arising in part from the powerful influence which a small quantity of blood produces in infants; and secondly, because one leech will cause the loss of more blood in them than in adults, owing to the greater vascularity of the cutaneous system. It is apparent, therefore, that in the diseases of infants, leeching may, in most cases, be substituted for venesection. But in disorders which are rapidly fatal, as croup, opening the jugular vein is undoubtedly to be preferred, since it is necessary to produce an immediate and powerful effect. As children advance in years they become capable of bearing larger evacuations of blood; and, therefore, leeching excites a less influential effect. It is quite impossible to say at what age venesection ought to be substituted, or, in infancy, what number of leeches should be applied; since they take away such unequal quantities of blood. These are points which must be decided by the practitioner in each case. Here is a tabular statement of the amount of blood which Dr. James Blundell[2] has taken from children at different ages:—

Ages.	*Quantities.*
2 months	1 ounce to 1½ ounces.
4 „	1½ „ to 2 „
8 „	2 „ to 3 „
12 „	3 „ to 4 „
18 „	4 „ to 5 „
3 years	8 „ to 10 „
6 „	10 „ to 12 „

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[1] Dr. M. Hall, *op. supra cit.*

[2] *Lancet*, Sept. 20, 1828, p. 773.

But these quantities are exceedingly large, and in most instances greater than it will be found prudent to abstract. Guersent says, that from infants up to two years of age we ought never to draw more than three or four ounces of blood in twenty-four hours.[1]

2. *The local effects of leeching* must now be noticed. The jaws of the leech may be compared to three saws, each armed with sixty teeth. It is, therefore, not surprising that pain and afflux of blood to the wounded part should be occasioned by the laceration of the skin by a single leech. I have sometimes seen some of these animals produce intense redness to the extent of an inch around the bite. This is best observed when the skin is delicate, like that covering the mammæ of the female. Now when a number of these animals are applied, their united local effects must have some influence over a neighbouring disease. There are also certain topical effects which occur subsequently, such as ecchymosis; the irritation and inflammation of the mouths of the punctures; the diffused redness and the soreness in the parts intervening between the bites, which cannot be without influence over morbid action. They act on the principle of counter-irritation. In taking into consideration the beneficial influence of leeches, we must, therefore, not forget these, nor the fomentations and poultices subsequently employed. When leeches are applied to the temples, especially if they fix close to the external canthus, a diffused swelling frequently arises, similar to that caused by erysipelas. This is not referable to any noxious qualities of the animal, for it happens when the finest and most healthy are employed; nor to the teeth of the animal being left within the wound, since I have seen it when the leech has fallen off spontaneously.

In concluding these remarks on the local effects of leeches, I have only to add, that independently of the local irritation caused by the puncture, I believe the evacuation of blood from an inflamed part may be more beneficial than the same quantity taken by the usual operation of venesection. In other words, I am disposed to admit what were formerly termed the *derivative* effects of local bleeding. The amount of benefit obtained by the application of leeches to parts that have been injured by falls, &c. as in fractures and dislocations, has frequently appeared to me much greater than could be referred to the combined influence of the quantity of blood lost, and the local irritation of the punctures; so, also, with respect to the good effects of leeching hemorrhoidal tumours. Mr. Wardrop thinks more benefit is in some cases obtained by the application of leeches at a distance from the affected organ, constituting what has been termed a *revulsive* operation. These remarks will be sufficient to prove, that in estimating the therapeutic influence of leeches, the quantity of blood drawn is not the only element in the calculation; and, I think, in practice, constant proof will be found that leeching is more beneficial than can be accounted for by the mere quantity of blood drawn.

USES.—The following are some of the uses of leeches:—

1. *In children and delicate adults* (*as females and aged persons*) *leeches*

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[1] On the sensible effects of leeches on man, see Vitet, *Traité de la Sangs. Méd.* 1809.

often form an excellent substitute for general blood-letting, when the object is not to occasion any immediate or sudden effect on the disease. In children it is necessary to avoid applying them to the neck, or other parts where compression cannot be conveniently made.

2. *In local determinations of blood*, unattended with febrile symptoms, local blood-letting, when it can be resorted to, is generally, though not invariably, preferred to phlebotomy. The advantages of leeching over cupping are, the less pain, and the ease with which blood may be procured; for it is evident that in swelled testicle, in inflammation attending fractured limbs, and in acute inflammation of the mammary gland, patients could not, in most cases, bear the necessary pressure of the cupping-glass; and in some parts of the body, as the abdomen, blood can only be procured from cupping by a very dexterous manipulation.

3. In internal and other inflammatory affections, accompanied with constitutional disorder, the rule is to employ general in preference to local blood-letting. But circumstances occasionally render the reverse practice justifiable and proper, as where the disease is not active, and the patient delicate and weak. In many instances it will be found most advantageous to combine both modes of drawing blood: for example, in *abdominal inflammations*, the application of leeches, preceded by venesection, will sometimes do more good than the same quantity taken by the lancet alone. During the progress of *fever* with determination of blood to the brain, the application of leeches to the temples, after the use of blood-letting, is often attended with the best effects.

4. There are some diseases in which no substitute of equal efficacy can be found for leeches. Such, I conceive, are *hemorrhoidal tumours*, and *prolapsus of the rectum*. In these cases general is not equal to local blood-letting, and cupping is out of the question.

5. *In various organic diseases* leeches will often be found an exceedingly useful palliative means. I would particularly mention as examples, affections of the heart and lungs.

6. Dr. Crampton[1] recommends the application of leeches to the internal surfaces; as to the conjunctiva in ophthalmia, to the tonsils in cynanche tonsillaris, and to the internal surface of the nostrils in epistaxis. The mode of applying a leech to the tonsils is as follows: pass a single thread of silk through the body of the leech, and make fast the ligature to the finger of the operator: then apply the leech to the part.

There are few diseases in which loss of blood is required, where leeching is positively objectionable; indeed, erysipelas is the only one that can be named. Here it has been supposed that the local irritation caused by leeches would add to the severity of the malady; but I believe that even in this case the objections are more imaginary than real. There are, however, numerous instances in which leeching is negatively objectionable: in some the quantity of blood drawn by these animals is insufficient to make much impression on the disease, as in visceral inflammation of robust persons; in others, where the disease is very rapid and fatal, the effects of leeches are too slow, as in croup. Venesection is the remedy in all these instances.[1]

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[1] *Dublin Hospital Reports*, vol. iii. 1822.

MODE OF APPLYING LEECHES.—Let the part be well cleansed (sometimes it may be necessary to shave it): then dry the leeches, by rolling them in a clean linen cloth: place them in the lid of a pill-box, and apply to the affected part. This is a preferable method to applying them by the fingers, or in a wine-glass. A narrow tube (called a *leech-glass*) will be found useful when we wish to affix one of those animals to the inside of the mouth, or any particular spot. [By grasping the body of the leech gently in a dry cloth, its head may be directed to any part where we wish it to be applied; and by gently withdrawing it as its head reaches the skin, we may compel the animal to fix its head to the spot, and insert its teeth.—ED.] Several circumstances influence the fixing of leeches; as the condition of the animal, whether healthy or otherwise; the nature and condition of the part to which it is applied: thus, leeches will not readily attach themselves to the soles of the feet, or the palms of the hands, or to the hairy parts—the presence of grease, vinegar, salt, and some other substances, will prevent them from biting; whereas milk, sugared water, and blood are said to have the contrary effect. Scarifying the part promotes their attachment. The condition of the patient also affects the fixing of the animal. Derheims[2] says that leeches will not bite those under the influence of sulphur, on account of the evolution of sulphuretted hydrogen by the skin. The effluvia, or vapours of the room, as the fumes of tobacco, sulphur, vinegar, &c., will prevent them biting, or even cause them suddenly to fall off.

The quantity of blood which a leech is capable of drawing varies considerably. I believe four drachms to be the maximum. On an average I do not think we ought to estimate it at more than one drachm and a half. Of course this has no reference to that lost after the animal has fallen off, and which varies according to the vascularity of the part; in children being oftentimes very considerable. When the leech has had sufficient it drops off; but it is said that if the tail be snipped, the animal will continue to bite, the blood passing out posteriorly as fast as it is taken in by the mouth. I have tried several, but they usually let go their hold the instant the tail is cut. H. Cloquet[3] has made the same remark. In order to disgorge the leech of the blood, the usual practice is to apply salt to its body; but it is objectionable (if you wish to preserve the animal), since the surface is frequently thereby blistered, and several days elapse ere the creature regains its former activity. Some advise squeezing the blood out by the mouth; others the application of diluted vinegar to the head. If no kind of emetic be employed, the blood remains for a considerable time in the stomach of the leech undigested, but without putrefying.

AFTER-TREATMENT.—When leeches have fallen off it is generally desirable to promote the sanguineous discharge. This is best done by the use of warm fomentations or cataplasms; or even, in some cases, by cupping-glasses. Great caution is necessary in the case of children. Some years since, the application of a leech was ordered to the chest of a child labouring under pneumonia; it was at the same time mentioned that the bleeding should be encouraged. The directions were literally fulfilled—the discharge of blood was assiduously promoted—until so large a quantity had been lost, that death was the result. No attempt was made to stop it, nor notice sent to the Dispensary, in the practice of which the case occurred. The child being illegitimate, and the mother evidently careless of its recovery, led some to suspect that this did not take place through mere ignorance. In another instance two leeches were ordered for a child aged about eighteen months, suffering from pneumonic inflammation, a consequence of measles. The following day the poor little creature was found in a fainting, or rather dying, state, with face and lips completely blanched. On inquiry it appeared the leech-bites were still bleeding, and no attempt had been made to stop the discharge, the mother thinking it would be beneficial, especially as the pneumonic symptoms had considerably abated. As predicted, the little sufferer died within twenty-four hours.

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[1] For a more extended account of the uses of leeching, see Dr. R. Price, *Treatise on the Utility of Sanguisuction*, 1822.

[2] *Hist. Nat. et Méd. des Sangs.* p. 134, 1825.

[3] *Dict. de Médec.* art. *Sangsue*, p. 83.

In some persons there appears to be an hereditary predisposition to hemorrhage, so that very slight wounds are attended with serious and even fatal effects. Mr. Wilson, quoted by Mr. Wardrop,[1] has related the case of a child where one leech had nearly caused death, by the serious hemorrhage. When about three or four years old, this child bit its tongue, and notwithstanding that every attempt was made to stop the discharge, death took place from the loss of blood. I have been called to many cases of hemorrhage after leech-bites, and have never failed in stopping it by compression. Sometimes mere exposure to the air will be sufficient; or, if this fail, we may apply a dossil of lint and a bandage. In other instances this will not succeed. I usually employ compression, thus: roll a piece of lint into a fine cone, and introduce it into the bites by means of a needle or probe; over this lay a compress and bandage. Sponge may be substituted for the lint. Various other modes have been proposed; some, I think, exceedingly cruel, since I do not believe them ever necessary. I allude, now, to the application of a red-hot needle; and to passing a needle through the orifice, and wrapping thread round, just as a farrier stops the discharge of blood from the vein of a horse. Some employ absorbing powders, as gum arabic; or styptic washes, as a saturated solution of alum. One very effectual means is to apply a stick of lunar caustic scraped to a point, or powdered nitrate of silver. Sir Charles Bell, in one case, stitched up the wound.

Accidents from Leeches in the Mucous Cavities.—The ancients were very apprehensive of the ill consequences likely to arise from swallowing leeches. That their fears were not groundless is proved from the following circumstances, related by the celebrated Baron Larrey. When the French army entered upon the deserts which separate Egypt from Syria, the soldiers, pressed by thirst, threw themselves on their faces, and drank greedily of the muddy water, and which, unknown to them, contained leeches (*Sanguisuga ægyptiaca*), having the form of a horse-hair, and the length of a few lines only. Many of them felt immediately stings, or pricking pains, in the posterior fauces, followed by frequent coughs, glairy sputa slightly tinged with blood, and a disposition to vomit, with a difficulty of swallowing, laborious respiration, and sharp pains in the chest, loss of appetite and rest, attended with great uneasiness and agitation. On pressing down the tongue of the individual first attacked, a leech was discovered, which was with difficulty removed by the forceps. Little or no hemorrhage followed, and the patient recovered. Those which had attached themselves to the posterior fauces were removed by the use of gargles composed of vinegar and salt water. The Chief of Brigade, Latour-Mauberg, commander of the 22d regiment of chasseurs, swallowed two in the deserts of St. Makaire, a day's journey from the Pyramids, which so much weakened him, that his convalescence was long and difficult.

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[1] *Op. supra cit.* p. 13.

Derheims[1] relates a case where a young man, who had leeches applied to his anus, was so unfortunate as to have one enter his rectum unnoticed. The animal made several punctures, and was not expelled till some hours after, when salt water injections were used. The wounds caused by the bites, however, did not heal for several months, during which time the patient suffered considerably, and constantly passed blood with the fæces. Whenever practicable, salt-water injections should be resorted to. In the following cases, related by Derheims,[2] this practice could not be adopted. Two small leeches were applied to the gums of an infant during the period of dentition, and by the inattention of the nurse they fixed themselves at the back part of the mouth, and becoming gorged with blood, caused great difficulty of respiration. The infant, by strongly closing the jaws, prevented the removal of the animals, which only ceased their hold, when they were filled with blood. The hemorrhage continued for two hours.

Ill effects have resulted from swallowing leeches. A lady accidentally swallowed a leech she was applying to her gums. Acute cardialgia soon came on, with a feeling of erosion and creeping in the interior of the stomach; sometimes convulsive movements in the limbs and muscles of the face; frequency and irregularity of the pulse; universal agitation and paleness of the countenance. The physician who was called in, recollecting the fact ascertained by Bibiéna, that leeches could not live in wine, administered half a glass every quarter of an hour. The symptoms were soon alleviated; and the fourth dose caused vomiting, by which the dead leech was evacuated, with much glairy matter, mixed with clots of black blood. By a proper subsequent treatment the patient recovered in eight days.[3]

[The following case occurred within our knowledge:—A lady was directed to apply a leech to the septum of the nose. By some accident the animal insinuated itself into the nasal cavities, and, reaching the posterior nares, the patient was irresistibly compelled to swallow it. No uneasiness was felt, probably owing to the leech having already drawn much blood. A moderately strong solution of chloride of sodium was administered at short intervals. The leech was not discharged by vomiting, and it did not pass by the bowels. The patient suffered from no unusual symptoms, probably owing to the early administration of the solution of salt.—Ed.]

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[1] *Op. supra cit.* p. 140.
[2] Page 140.
[3] *Recueil périodique.*

Class VI. Insecta, *Goldfuss.*—Insects.

Characters.—*Articulated* animals with 6 *feet* (*hexapoda*), one pair of *antennæ*, a *dorsal vessel* for circulation, respiring by *tracheæ*, and undergoing *metamorphosis* (being successively *ovum*, *larva*, *pupa*, and *imago*). *Head* distinct from the thorax.

Order I. COLEOPTERA, *Linnæus.*—BEETLES.

Characters.—4 *wings*, of which the two upper or anterior (*elytra* or *wing cases*) are horny or leathery, united down the back by a straight suture; lower or posterior wings folded longitudinally. *Mandibles* and *jaws* for mastication.

374. CANTHARIS VESICATORIA, *Latreille, L. E. D.*—THE BLISTER BEETLE, OR SPANISH FLY.

Lytta vesicatoria, *Fabricius;* Meloë vesicatorius, *Linnæus.*

(The whole fly, *E.*)

History.—Hippocrates employed in medicine an insect which he calls *κανθαρὶς*, whose effects were similar to those of our *Cantharis vesicatoria.* Hence it has been erroneously inferred by some writers that our blistering beetle is identical with that employed by the ancients. That this inference is incorrect is proved by the following facts. In the first place, many beetles agree in their effects on the system with those of Cantharis vesicatoria; secondly, the word *κανθαρὶς* merely signifies *a small beetle* or *scarabæus parvus;* thirdly, both Dioscorides[1] and Pliny[2] refer to several kinds of *cantharides*, but remark that the most powerful are those with transverse yellow bands on the wings, and that those which are homogeneous in colour are weak and inert. It is tolerably clear, therefore, that neither of these ancient writers was acquainted with Cantharis vesicatoria. Now the characters assigned to the ancient blistering insect agree precisely with those of two species of *Mylabris*. Burmeister[3] suggests that *Mylabris Füsselini*, a native of the south of Europe, was the species used by the ancients. *Mylabris Cichorii* is employed as a blistering beetle at the present day in China and some parts of Hindostan, and may perhaps have been used by the Greeks and Romans.

Zoology. **Gen. Char.**—*Antennæ* elongate, simple, filiform. *Maxillary palpi* with terminal joint somewhat ovate. *Head* large, heart-shaped. *Thorax* small, rather quadrate, narrower than the elytra, which are as long as the abdomen, soft, linear, the apex slightly gaping. *Wings* two, ample (J. F. Stephens).[1]

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[1] Lib. ii. cap. 65.

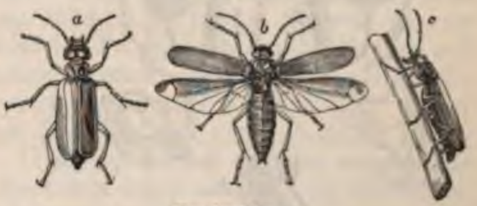
[2] *Hist. Nat.* lib. xxix. cap. 30, ed. Valp.

[3] *Man. of Entomol.* by Shuckard, p. 562, 1836.

Sp. Char.—Bright glossy brass-green or bluish, glabrous; beneath more glossy, with a few hairs. *Breast* densely pubescent, finely punctured. *Head* and *thorax* with a longitudinal channel. *Elytra* with two slightly raised lines. *Tarsi* violaceous. *Antennæ* black, with the basal joint brassy (J. F. Stephens).

Form elongated, almost cylindrical. *Length* six to eleven lines. *Breadth* one to two lines. *Colour* brass or copper green. *Odour* nauseous, unpleasant. *Body* covered with whitish grey hairs, which are most numerous on the thorax. *Head* large, subcordate, with a longitudinal furrow along its top. *Eyes* lateral, dark brown. *Thorax* not larger than the head, narrowed at the base. *Elytra* from four to six lines long, and from 3-4ths to 1½ lines broad; costa slightly margined. *Wings* ample, thin, membranous, veined, transparent, pale brown; tips folded. *Legs* stout, from four to six lines long, the hinder ones longest: *tibiæ* clavate, in the female all terminated by two small moveable *spurs;* in the male the two hinder pairs of extremities alone have this arrangement, the anterior ones having but one spur; last joint of the *tarsi* with a pair of bifid claws. *Abdomen* soft, broadest in the female. In the female, near the anus, are two articulated, caudal appendages.

FIG. 117.



Cantharides.

The *internal organisation* of these animals has been elaborately studied by Audouin[2] and by Brandt.[3] THE NERVOUS SYSTEM consists of a cerebro-spinal axis, and a double and single sympathetic system. The *cerebro-spinal axis* consists of a double nervous cord, and nine ganglia (two cephalic, one of which is the brain, three thoracic, and four abdominal). The *single sympathetic system* commences at the brain by two branches, which unite at the ganglium frontale, from which a single nerve proceeds along the œsophagus to the stomach, where it divides into two, forming at its division a small ganglion. The *double sympathetic system* consists of four ganglia placed on the œsophagus, two on either side of the single nervous cord just described, with which, as well as with the brain, they are connected by nervous twigs. THE VASCULAR SYSTEM consists of *a simple pulsating dorsal vessel,* which extends from the head to the extremity of the abdomen. THE RESPIRATORY SYSTEM consists of ten pair (three thoracic, seven abdominal) of stigmata, which open into the tracheæ. THE DIGESTIVE SYSTEM consists of the *mouth,* which terminates in the *pharynx.* The latter contracts into a long muscular *œsophagus,* which ends in an elongated fusiform *stomach.* The latter is marked transversely by bands formed by the muscular coat. Between the stomach and intestine is a *valve* (pylorus) formed by four small, floating, kidney-shaped bodies. The *small intestine* forms two curvatures, and then proceeding directly backwards, terminates in the swollen *cæcum,* which ends in the very short narrow *rectum.* The *biliary vessels* consist of six very long, filiform, convoluted tubes, which terminate anteriorly at the stomach near the pylorus, and posteriorly at the intestine near the cæcum. THE SEXUAL SYSTEM of the MALE consists of a pair of spherical *testicles,* having externally a granulated appearance; two *vasa deferentia,* which have a ringed appearance; three or four pair of tubes (*seminal vesicles* or *epididymoid vessels*), the functions of which are imperfectly known; a *common spermatic duct;* and a *penis*, which has three barbs or *hooks* at its extremity, and is enveloped by a *sheath*. THE FEMALE ORGANS consist of two large, hollow, egg-shaped *ovaries*, the cavities of which are called *calyces*. On their external surface is an immense number of pyriform *egg tubes*. From each ovary or calyx arises an *oviduct*, and the two oviducts by their junction form the *common oviduct*, the lower portion of which is called the *vagina*. Into the common oviduct passes a *tube* from a vesicular bag, called *spermatheca* (*vesicule copulatrice*, Audouin), and also from other *appendages* (*sebaceous glands*, Audouin).

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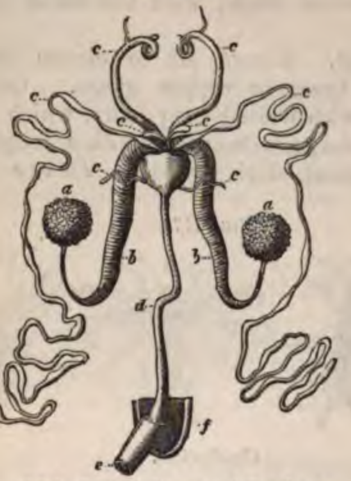
[1] *Man. of Brit. Coleopt.* p. 334, 1839.
[2] *Ann. des Scienc. Nat.* t. ix. p. 31.
[3] *Med. Zool.* ii.

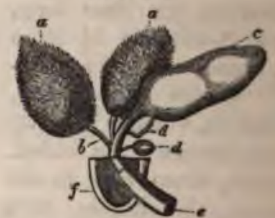
FIG. 118.



Male Genital Organs of Cantharis vesicatoria.

a a, Testicle.
b b, Vasa deferentia.
c c, *c c*, *c c*, *c c*, The four pair of vesiculæ seminales, or epididymoid vessels.
d, The common spermatic tube.
e, Portion of the intestinal tube inverted.
f, Last abdominal ring.

FIG. 119.



Female Organs of Cantharis vesicatoria.

a a, The ovaries covered by the egg tubes: each ovary sends out an oviduct, *b*. The two ducts unite to form the common oviduct, which receives the excretory tube of the *spermatheca*, *c*, and of other appendages, *d d*.
e, Portion of the inverted intestine.
f, Last abdominal ring.

I must refer to Audouin's paper for an amusing account of the amours of these animals.

Hab.—Europe. Originally, perhaps, a native of the southern parts, especially Italy and Spain. Now found in France, Germany, Hungary, Russia, Siberia, and England. With us they are rare. In the summer of 1837 they were abundant in Essex and Suffolk.[1] They are found on species of *Oleaceæ* (as the ash, privet, and lilac,) and of *Caprifoliaceæ* (as the elder and Lonicera).

MODE OF CATCHING CANTHARIDES.—In the south of France these animals are caught during the month of May, either in the morning or evening, when they are less active, by spreading large cloths under the trees, which are then strongly shaken, or beaten with long poles. The catchers usually cover their faces, and guard their hands by gloves.[2] Various methods have been recommended for killing the insects; such as exposing them to the vapour of vinegar (the practice mentioned by Dioscorides), or of hot water, or of spirit of wine, or of the oil of turpentine,

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[1] Westwood, *Intr. to the Mod. Classif. of Insects*, vol. i. 1839.
[2] Richard, *Dict. des Drog.* i. 550.

Geiger states, that if destroyed by dropping oil of turpentine into the bottle in which they are contained, they are not subject to the attack of mites; but I believe they are more frequently destroyed by immersing the cloths containing them in hot vinegar and water, and then drying on hurdles covered with paper or cloths.

PRESERVATION.—Cantharides should be preserved in well-stoppered bottles, and to prevent them from being attacked by mites (*Acarus domesticus*), a few drops of strong acetic acid should be added to them. I have found this a most successful mode of preservation. Besides mites, they are subject to the attacks of a moth (*Tinea flavifrontella*) and two coleopterous insects (*Anthrenus muscorum* and *Hoplia farinosa*).

COMMERCE.—Cantharides are imported from St. Petersburgh, in cases, each containing 160 or 170 lbs.; and also from Messina, in barrels or cases, holding each about 100 lbs. They are principally brought over towards the end of the year. In 1839, duty (1s. per lb.) was paid on 16,376 lbs. The cantharides from St. Petersburgh are the largest and most esteemed. They are somewhat more copper-coloured than the French or English varieties, which have rather a brassy than copper tint. Sir James Wylie[1] states that they are very abundant in the southern provinces of Russia. [Large quantities are also collected in Hungary, and are brought to market in cases or casks by the way of Hamburg. A blistering beetle is occasionally imported from China, and sold under the name of China cantharides.—ED.]

CHARACTERISTICS FOR MEDICO-LEGAL PURPOSES.—There are no *chemical tests* for cantharides to be relied on. Orfila[2] has published an account of the effects of various reagents on tincture of cantharides; but they are unimportant. Cantharides are rarely met with in a sufficiently perfect form to enable us to recognise them by their *zoological characters*. Their *physical characters* are much more important. In all powders of cantharides golden green particles may be distinguished; these may be separated from the other contents of the stomach by immersing them in boiling water: the fatty matter rises to the surface, while the cantharides powder falls to the bottom. Orfila has recognised these particles in a body nine months after interment; so that they do not readily decompose, even when mixed with decaying animal matters. [A portion of the suspected substance spread in a thin layer should be allowed to dry on a piece of glass. When dried, either by the naked eye or by the aid of a lens the green and copper-coloured particles of the wings may be seen, if cantharides be present, on one or both sides of the glass.—ED.] Some other insects, however, have the same golden-green colour, but are without vesicating properties; and *vice versâ*, there are many insects which vesicate, but which have not a golden-green colour. The physical characters of the particles, aided by their *physiological effects*, together form tolerably conclusive evidence of the presence of cantharides. To judge of the effects of cantharides, and their preparations, we should proceed as follows:—If the suspected matter be a liquid, evaporate it to the consistence of an extract; then digest in repeated quantities of sulphuric ether. The ethereal solutions are to be mixed, and allowed to evaporate in the air: the vesicating properties of the residuum may be determined by applying it to the inside of the lip or to the arm. If the suspected matter contain solid particles, these are to be digested in ether, and the concentrated tincture applied to the inner surface of the lip.[1] Dr. Hastings[2] has published an interesting fatal case of inflammation of the alimentary canal and urinary organs. The symptoms simulated those caused by excessive doses of cantharides; but the moral and other evidence seemed to negative the suspicion that insects had been taken.

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[1] *Pharmacopœia Castrensis Ruthenica*, p. 243, Petropoli, 1840.

[2] *Toxicol Gén.*

ADULTERATION AND GOODNESS.—The goodness or quality of cantharides may be recognised by their odour, and freedom from other insects, especially mites. Sometimes the powder, but more commonly the plaster, is adulterated with powdered euphorbium. I have been informed, by persons well acquainted with the fact, that it is a common practice, amongst certain druggists, to mix one pound of euphorbium with fourteen pounds of powdered Spanish flies.

COMPOSITION.—Cantharides were analysed in 1803 by Thouvenal,[3] in 1804 by Beaupoil,[4] and in 1810 by Robiquet.[5]

Thouvenal's Analysis.	
Watery extract	37·50
Subsequent alcoholic extract ...	10·42
Subsequent ethereal extract ...	2·08
Insoluble residuum ...	50·00
Total...	100·00

Beaupoil's Analysis.	
Black matter, insoluble in alcohol, but soluble in water	12·94
Yellow matter, soluble in water, alcohol, and ether	12·94
Green oil, soluble in alcohol and ether ...	13·99
Parenchyma, salts, and oxide of iron	66·13
Phosphoric acid.........	?
Total.........	100·00

Robiquet's Analysis.

1. *Cantharidin.*
2. Green fatty oil, soluble in alcohol.
3. Fatty matter, insoluble in alcohol.
4. Yellow viscid substance, soluble in water and alcohol (osmazome?).
5. Black matter, soluble in water, insoluble in alcohol.
6. Yellow matter, soluble in ether and alcohol.
7. Free acetic and uric acids.
8. Phosphate of lime, and phosphate of magnesia.

Cantharis vesicatoria.

1. CANTHARIDIN, ($C^{10}H^{6}O^{4}$) (*Vesicatorin; Cantharides-Camphor*).—Has been found in *Cantharides vesicatoria*, *Lytta vittata*, *Mylabris Cichorii*, and other vesicating insects. Probably exists in all the blistering beetles. To procure it, concentrate an alcoholic tincture (prepared by percolation) and set aside: the cantharidin slowly crystallises. It is purified by washing with cold alcohol, and boiling with alcohol and animal charcoal. Its properties are as follows:—It crystallises in the form of micaceous plates, which are fusible, forming a yellow oil, which by a stronger heat is vaporisable, forming white vapours: these subsequently condense into acicular crystals of cantharidin. Dana regards it as an organic alkali, but without any just grounds; for it will not restore the blue colour of litmus paper reddened by an acid [and it will not combine with acids or alkalies to form salts]. Gmelin's opinion, that it is a solid volatile oil, seems to be correct. When isolated, it is not soluble in water, but becomes so by combination with the other constituents of cantharides; the yellow matter probably being the principal agent in rendering it so. This, then, is the reason why an aqueous infusion of the insects contains cantharidin in solution. Cold spirit, digested on cantharides, extracts cantharidin; which it can only do by the agency of some of the other principles of the flies. It is easily soluble in ether, oils (volatile and fixed), and hot spirit of wine; and from the latter it separates as the liquid cools.

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[1] See *Ann. d'Hygiène Publique*, 1835, xiii. p. 455.

[2] *Trans. of the Provin. Med. and Surg. Assoc.* vol. i. p. 402.

[3] *Ann. de Chim.* xlvii. 230.

[4] *Ibid.* xlviii. 29.

[5] *Ibid.* lxxvi. 302.

Concentrated boiling sulphuric acid dissolves cantharidin: the solution is slightly brown; when diluted with water it deposits small needle-like crystals of cantharidin. Boiling nitric and hydrochloric acids dissolve it without changing colour; the solutions, by cooling, deposit it. Cantharidin is dissolved by potash and soda; but when concentrated acetic acid is added to the solution, the cantharidin is precipitated. Ammonia is without action on it. According to Regnault it consists in 100 parts of *carbon*, 61·68; *hydrogen*, 6·04; and *oxygen*, 32·28.

[In addition to the properties above described, it may be stated that cantharidin is very soluble in chloroform. This liquid will remove it from an aqueous solution of the flies. Boiling acetic ether dissolves it. Acetone obtained by distillation from acetate of lime is also a good solvent, ranking next to chloroform in this respect, according to Mr. Procter. Oils also exert a solvent power over it. Mr. Procter found that twenty parts of olive oil mixed with one part of cantharides and heated to 250° F. completely dissolved the cantharidin. As the solution cooled the cantharidin separated in shining needles. It is also soluble in about seventy parts of oil of turpentine.[1] Its specific gravity is 1·38: it is very acrid: its powder applied to the skin with a little oil produces speedily vesication. Taken internally it acts as a powerful irritant poison.—ED.]

Robiquet thus describes the effects of cantharidin:—The 1-100th part of a grain, placed on a slip of paper and applied to the edge of the lower lip, caused, in about a quarter of an hour, small blisters. A little cerate being applied served only to extend the action over a larger surface, and both lips were in consequence covered with blisters. Some atoms of cantharidin, dissolved in two or three drops of almond oil, were rubbed over a small piece of paper, and applied to the arm; in six hours the blister was formed, the size of the paper. The *volatility* of cantharidin at a comparatively low temperature, and the action of the vapour on the conjunctival membrane, are supposed to be shown by the accident which happened to one of Robiquet's pupils, who was watching its crystallisation, and felt acute pain in the conjunctiva, which was followed by inflammation, accompanied with small phlyctenæ, and loss of sight for several days. Robiquet, who was not so near the liquid, suffered but slightly. I have suffered once in preparing this substance. I applied one drop of an ethereal solution of impure cantharidin to the inside of the lower lip; but immediately afterwards, repenting of my temerity, I wiped it carefully off. In about an hour a blister had formed on the inside of the lip, and it was five or six days before the part had completely healed. Bretonneau, in his experiments on animals, has not found any marked aphrodisiac effect produced by cantharidin. He found that it rendered the circulation slower, and caused fatal lethargy.

[Mr. Procter considers from his experiments that cantharidin is not so volatile as this observation by Robiquet would lead the reader to suppose. Any irritating effects of this nature are, in his opinion, the result of contact with this principle, and are not owing to the volatility of cantharidin. The effect on the eye in the case of Robiquet's pupil, he attributes to the vapour of ether. Mr. Procter found by direct experiment, that a certain weight of cantharidin, kept at 212° for half an hour, lost nothing appreciable, and there was no sublimate formed visible by a lens. At 220°, no visible effect was produced. Kept at 250° for twenty minutes, a very slow sublimation was produced: at 300° this was but slightly increased: at 360° the sublimation was slow but decided. Between 402° and 410° the cantharidin melted, and rapidly sublimed at a few degrees higher. At this temperature Mr. Procter found that cantharidin was easily volatilised, and it condensed in beautiful well defined crystals like solicylic acid.[2]—ED.]

2. VOLATILE ODOROUS OIL.—Orfila asserts that volatile odorous oil is one of the constituents of the insects. The distilled water of cantharides is strongly odorous and milky; and its vapour affects the eyes and kidneys like cantharides.

The active and odorous principles of cantharides reside principally in the sexual organs of the animals. Both Farines and Zier tell us, that the soft contain more active matter than the hard parts. It appears, also, that the posterior is much more acrid than the anterior portion of the body; and Zier says the ovaries are particularly rich in this active matter. If so, it is evident that we ought to prefer large female to male insects. It is a well-known fact, that the odour of these animals becomes much more

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[[1] *Pharm. Journal*, vol. xii. p. 287.

[2] See *Pharmaceutical Journal*, vol. xii. p. 288.]

powerful at the season of copulation than at other periods; and that persons sitting under the trees in which these insects are found, at this season more particularly, are very apt to be attacked with ophthalmia and ardor urinæ.

Physiological Effects. *α. On Animals.*—The principal experiments with cantharides on animals (dogs) are those of Orfila and Schubarth.[1] It results from their investigations, that these insects cause violent inflammation in the parts to which they are applied, and an affection of the nervous system (spinal cord principally). Injected into the jugular vein, the oleaginous infusion caused tetanus; introduced into the stomach, the œsophagus being tied, the tincture produced insensibility (Orfila). Inflammation of the inner coat of the bladder was observed when the poison had remained in the stomach for a few hours before death.

β. On Man.—*The topical effects* of cantharides are those of a most powerful acrid. When these insects are applied to the *skin*, the first effects noticed are, a sensation of heat, accompanied by pain, redness, and slight swelling. These phenomena are soon followed by a serous effusion between the corium and epidermis, by which the latter is raised, forming what is commonly termed a *blister*, or, in the more precise language of the cutaneous pathologist, an *ampulla* or *bulla*. The effused liquid has a pale yellow colour, with a very feeble taste and smell. Two analyses of it have been made:—

Analysis by Dr. Bostock.	
Albumen	6·00
Uncoagulable matter,	0·14
Salts	1·00
Water	92·86
	100·00

Analysis by Brandes and Reimann.	
Albumen	5·75
Animal matter, with muriate of ammonia, potash salts, carbonate, lactate, muriate and sulphate of soda	0·26
Water	93·99
	100·00

If the cuticle be removed, the subjacent corium is seen intensely reddened, and by exposure to the air, oftentimes becomes exceedingly painful. If irritants be applied, a secretion of pus takes place, and sometimes a whitish-looking false membrane is formed. Long-continued irritation occasionally causes tubercular granulations. Not unfrequently I have noticed ecthymatous pustules around the blistered surface; and in one remarkable case which fell under my notice, the whole body, but more especially the pectoral region (to which the blister had been applied), was covered with them. Sometimes the vesicles of eczema occur. Ulceration and gangrene are not uncommon: the latter effect is occasionally observed after exanthematous diseases, especially measles. I have seen death result therefrom in two instances. The constitutional symptoms frequently produced are excitement of the vascular system (as denoted by the increased frequency of pulse, heat of skin, and furred tongue), and irritation of the urinary and genital organs (marked by heat and pain in passing the urine, which is usually high coloured, or there may be complete suppression). It not unfrequently happens that the part to which a blister has been applied remains considerably darker coloured than the surrounding skin. Rayer states, that the disappearance of these discolorations is hastened by the use of sulphurous baths.

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[1] *Toxicol. Gén.*

[2] Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 262.

When swallowed, cantharides act topically on the *gastro-intestinal membrane;* in poisonous quantities they excite inflammation of the mucous lining of the alimentary canal, with constriction and difficulty of swallowing, which is sometimes so great, that not a particle of fluid can be got into the stomach without inexpressible anguish; violent burning pain, nausea, vomiting, frequently of bloody matters, sometimes with flakes like the inner lining of the alimentary tube, and great tenderness to touch. These phenomena sufficiently indicate the gastric inflammation. Ptyalism is not an uncommon occurrence. The enteritic symptoms are, abundant and frequent evacuations, sometimes of blood, with horrible griping and burning pain, and exquisite sensibility of the abdomen.

The *volatile odorous matter* evolved by these insects is a local irritant; for it causes itching and even inflammation of the eyelids and conjunctiva, irritation of the air-passages, marked by epistaxis, convulsive sneezing, &c. If it be inhaled, as is done when persons sit under trees on which the animals are found, or by breathing the vapour of decoction of cantharides, an affection of the urinary organs may be brought on. The same remote effects may also be excited by blisters, or by handling the insects, by applying them to wounds, by swallowing them, or by injecting solutions of their active principle into the veins. We may classify the *remote effects* of cantharides into those observed in the urino-genital, the nervous, and the vascular systems.

αα. Action on the Urino-genital system.—The pain in the loins, and the alteration in the quantity and quality of the urine, are the symptoms indicative of the inflamed condition of the kidneys. The burning pain and tenderness in the hypogastric region, and the constant desire to pass the urine, with the inability of doing so except drop by drop, are evidences of the vesical inflammation. The action on the genital organs in the male is proved by priapism, which is sometimes accompanied by satyriasis, sometimes not; and by the occasional inflammation and mortification of the external organs. In the female, the action on the sexual system is shown by the local heat and irritation, and by the occasional occurrence of abortion.

ββ. Action on the nervous system.—The affection of this system is proved by the pain in the head, disordered intellect, manifested in the form of furious or phrenitic delirium, convulsions of the tetanic kind, and subsequently coma. It is deserving of especial notice, that sometimes several days elapse before the nervous symptoms show themselves: thus, in a case related by Giulio, they appeared on the third day; in another instance, mentioned by Graaf, on the eighth; and in a case noticed by Dr. Ives, they were not observed until the fourteenth day.[1]

γγ. Action on the vascular system.—The pulse becomes hard and frequent, the skin hot, and the respiration quickened; diaphoresis is occasionally observed.

The susceptibility to the influence of cantharides is by no means uniform. Werlhoff mentions the case of a lad who used to be attacked with priapism and involuntary emission by merely smelling the powder. Amoreux says, in one case a pinch of the powder caused death; while in another a spoonful occasioned only slight heat in the throat, and ardor urinæ. Dr. Hosack has mentioned an instance in which a man took nearly six ounces of the tincture with the view of self-destruction, yet no dangerous symptoms followed. In contrast with this, I may instance a case that came within my own knowledge, where one ounce of the tincture produced serious symptoms. Orfila has seen twenty-four grains of the powder prove fatal.

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[1] See Christison, *Treatise on Poisons.*

1. *Action in small or medicinal doses.*—In very small quantities there are no obvious effects. If we increase the dose, a sensation of warmth is felt in the throat, stomach, and respiratory passages, with increased secretion from the alimentary tube. By continued use, a tickling or burning sensation is experienced in the urethra, with frequent desire to pass the urine, which may or may not be altered in quality and quantity. In some cases diuresis is observed, in others not: in the latter the urine is generally higher coloured than usual. Occasionally the sexual feelings are excited.

2. *Action in larger doses: Subacute poisoning.*—The symptoms are, heat in the throat, stomach, intestines, and respiratory passages; pain in the loins, burning sensation in the bladder, with frequent desire to evacuate the urine, which is sometimes bloody, and passed with difficulty. Painful priapism, with or without satyriasis. Pulse more frequent, skin hot, and the respiration quickened: the nervous system is frequently excited.

3. *Action in still larger doses: Acute poisoning.*—The symptoms observed are, in part, common to other irritant poisons; in part peculiar to the vesicating insects. Violent burning in the stomach, with exquisite sensibility and constant vomiting; extreme thirst, dryness, and fetid odour of the mouth, and not unfrequently ptyalism. Burning pain and spasmodic contraction of the bladder, giving rise to the most excruciating agony. Notwithstanding the incessant desire to void urine, nothing but drops of blood are passed, and with great pain. The constriction of the throat and difficulty of deglutition are most distressing and alarming: the unfortunate sufferer is constantly tormented with violent gripings, purging, generally of blood, extreme tenderness of the whole abdominal surface, faintings, giddiness, convulsions, and an almost hydrophobic aversion to liquids, with delirium terminating in coma.

The mode and immediate cause of death are various: sometimes the nervous symptoms kill before gangrene makes its appearance; but more usually the patient dies from inflammation and subsequent mortification of the alimentary tube or of the genital organs.

POST-MORTEM APPEARANCES.—On opening the bodies of persons poisoned by cantharides, inflammation and its consequences have been observed in the alimentary tube, and the urinary and genital organs. The cerebral vessels have been found in a congested state. It is deserving of notice that inflammation of the urino-genital organs is more likely to be met with in patients dying within a few days after poisoning.

USES.—Hippocrates used vesicating insects (under the name of cantharides) internally; but the practice was subsequently regarded as dangerous; and so lately as the year 1693, the President of the College of Physicians committed Dr. Groenvelt to Newgate for daring to employ them!!![1]

1. *Local Uses.*—Cantharides are frequently used as topical agents; sometimes as stimulants, sometimes as rubefacients, at other times as vesicants.

α. To stimulate topically.—Tincture of cantharides with water (in the proportion of three or four drachms of the tincture to a pint of water) has been employed *to stimulate ulcers;* more especially sinuses and fistulous sores. It is said, on the same principle that stimulant and irritant applications are made to the eye in ophthalmia; that is, to excite a new action, which shall supersede the old one. Matthew's once celebrated injection for fistula *in ano* is a wash of this kind.[2] In *alopecia* or *baldness*, when this is not the result of old age, unguents of cantharides have been employed to promote the growth of hair. Powdered cantharides have been advised as an application *to the parts bitten by rabid animals.*

β. To produce rubefaction.—For this purpose the tincture may be mixed with soap or camphor liniment; or, when it is desirable to limit the effect to a particular spot, and especially if friction be objectionable, the common blistering plaster may be applied, allowing it to remain in contact with the part for an hour or two only. Rubefacient liniments are employed to *excite the sensibility of the skin in numbness and paralysis;* as also *to promote local irritation in neuralgic and rheumatic pains.* In the *inflammatory affections of children* it will be occasionally found useful to employ the plaster as a rubefacient merely.

γ. To excite vesication.—A considerable number of substances (mineral, vegetable, and animal) cause vesication when applied to the skin. Horseradish, mezereon, liquor ammoniæ, and acetic acid, may be mentioned as examples. To these may be added heat, applied in the form of hot water, or a hot metallic plate. For facility of application, certainty of effect, and slightness of pain, no agents are equal to cantharides, and these are now almost solely used. It was formerly supposed that the efficacy of blisters was in proportion to the quantity of fluid discharged. But the truth is, that the therapeutic influence is in proportion to the local irritation, and has no more relation to the quantity of fluid discharged, than that the latter is frequently (not invariably) in the ratio of the former. Stoll's axiom is, therefore, correct:—"Non suppuratio sed stimulus prodest." As to the precise manner in which blisters, or, indeed, any remedies, influence diseases, we are quite in the dark. We are accustomed to refer their operation to the principles of counter-irritation. I must refer those who feel interested in the question whether blisters ought to be applied in the neighbourhood of, or at a distance from, the affected part, to a paper by Barthez, in the *Recueil de la Société Médicale de Paris.* In this country we generally apply them near to the morbid part; to which practice Barthez assents, with some exceptions.

We employ blisters in inflammatory diseases, both acute and chronic;

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[1] Groenvelt, *De tuto Cantharidum in medicinâ usu interno*, 12mo. Lond. 1698; Greenfield, *Treatise on Cantharides*, translated by Martin, 1706.

[2] Dr. Paris, *Pharmacologia.*

in the former, however, preceding their use by blood-letting. In chronic inflammatory disease we often employ what is termed a perpetual blister —that is, the cuticle is removed, and the blistered surface dressed with savine or cantharides ointment. This practice is advisable in chronic diseases of the chest, of the joints, of the eyes, &c. Blisters are sometimes used in erysipelas; thus to localise the disease when disposed to spread, and as a revulsive, applied to the feet, in erysipelas of the head. A blister to the perineum has been sometimes found beneficial in gleet. It is hardly safe to apply blisters to children immediately after exanthematous diseases, sloughing being not an unfrequent result. If it be required to produce in them counter-irritation, the best plan is to dilute the common blistering plaster, by mixing with it three times its weight of soap cerate. I have seen this compound frequently employed, but never observed any unpleasant results from it. Another plan, sometimes adopted, is to apply a common blister, for an hour or two only, so that it shall merely produce rubefaction.

2. *Remote uses.*—These will require examination under distinct heads, according to the particular object we have in view in employing cantharides.

α. To act specifically on the urinary organs.—In *dropsy* they have been used to excite diuresis, though they frequently fail in producing this effect. In *diabetes*, cantharides have been employed, but without apparent benefit. In *paralysis of the bladder* they are frequently useful, when there are no marks of local irritation. Two opposite conditions may be the result of paralysis of this organ; namely retention or incontinence of urine. The latter condition is not unfrequently met with in children, and is very likely to be relieved by cantharides. It is usually stated they are particularly serviceable in that species of incontinence which occurs during sleep only; but I have seen them cure the disease during the day, and fail in giving relief at night. The case alluded to was that of a boy, 14 years old, who had been subject to incontinence of urine since his infancy. He was a robust lad, and apparently in the most perfect health. I put him under the influence of gradually increased doses of cantharides, and within two months he was enabled to retain his urine by day, but it still passed involuntarily at night; and, though he continued the remedy for a considerable time, no further benefit was obtained. In incontinence of urine which occurs after lingering labours, from the long-continued pressure of the child's head, cantharides are sometimes serviceable. But their use must not be commenced until all the symptoms of local irritation have subsided.

β. To act on the organs of generation.—In consequence of the specific stimulus communicated by cantharides to the bladder, it has been supposed that the same influence might be extended to the uterus; and thus these insects have been employed as *stimulating emmenagogues*, in some cases with apparent benefit, but frequently without any obvious effect. Abortion has occasionally happened from their employment, as I have myself witnessed in one case.

Cantharides are also employed as *an aphrodisiac*, both in man and in other animals (as horses, heifers, and asses). In man, if given in sufficient quantity to excite the sexual feelings, they endanger the patient's safety. Most of the cases in which we are requested to administer aphrodisiacs, will be found, on examination, to require moral rather than pharmacological treatment. *In discharges from the genital organs,* beneficial effects are frequently obtained by the internal use of cantharides. In gleet they have been often found serviceable. Mr. Roberton[1] explains their efficacy by saying that they excite a mild inflammatory action on the urethra (shown by the discharge becoming thick, opaque, and puriform), which supersedes the previous morbid one. I have frequently found equal parts of tincture of chloride of iron and tincture of cantharides a successful combination in old-standing gonorrhœas. The dose is twenty drops at the commencement.

γ. *In chronic skin diseases.*—Pliny states that cantharides (*Mylabris*) were employed in a disease which he terms lichen. At the present time, tincture of cantharides is not unfrequently employed in *lepra, psoriasis,* and *eczema.* Having found other remedies very successful in lepra and psoriasis, I have rarely had occasion to try cantharides; but Rayer[2] says, "Of all the energetic and dangerous remedies that have been used in lepra, the tincture of cantharides is, perhaps, that which has the most remarkable influence over the disease. The great objection to its employment is its liability to excite inflammation in the digestive organs and urinary passages, especially among females, which necessitates the immediate suspension, and occasionally the entire abandonment, of the medicine." Biett has found it successful in chronic eczema, as well as in the scaly diseases.

δ. *In diseases of the nervous system,* cantharides were at one time in great repute. The cases in which they were employed were hydrophobia, epilepsy, chorea, tetanus, and mania. Experience has shown that they deserve little attention in any of these complaints.

ε. *In obstinate sores,* Mr. Roberton recommends cantharides on the same principle that he uses them in gleet.

[*On the relative action of Cantharides and Cantharidine.*—M. Schroff states that fifteen grains of cantharides killed a rabbit in five hours. Six grains of *cantharidine* killed another rabbit in from seven to ten hours, while in a third experiment three grains caused the death of the animal in three hours. From these results M. Schroff thought that a centigramme (gr. 0·15) or about one-seventh of a grain, would produce no injurious effect on a human being. The results of this dose, however, were so serious, as nearly to prove fatal. It is probable that the action of pure cantharidine is fifty times as powerful as that of cantharides. These insects, no doubt, contain variable quantities of this principle according to their size, sex, and age. M. Schroff thinks that if cantharidine be employed internally, the dose should be from the 1-100th to the 1-30th of a grain.

Ten drops of a freshly made tincture of cantharides produced erotic sensations. Nothing of the kind was observed as a result of the action of *cantharidine.* Pain in the loins was felt in both cases, but more slowly with cantharidine; and although there was violent inflammation of the bladder and ureter, no erotic symptom manifested itself. These results rather lead to the presumption that the aphrodisiac properties of the insect resides in a volatile principle, and not in the more fixed cantharidine. It is noticed that the insects, about the period of copulation, emit a very powerful odour; and it is a matter for further inquiry whether this is the principle which gives to them their aphrodisiac qualities. It is quite certain that some samples of cantharides fail to produce this effect when they have been criminally used for this purpose.[1]—Ed.]

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[1] *Practical Treatise on the Powers of Cantharides,* 1806.

[2] *Diseases of the Skin,* translated by Dr. R. Willis.

Administration.—*Powdered* cantharides are not unfrequently employed internally. The dose is one or two grains in the form of pill. The *tincture* is the safest preparation, and should, therefore, always be preferred.

Antidote.—In poisoning by cantharides, remove the poison as speedily as possible from the stomach. If sickness have not commenced, the removal may be effected by the stomach-pump, emetics, or tickling the throat (see treatment of poisoning by Opium, *ante*). Assist the vomiting by mucilaginous and albuminous demulcent liquids,—as linseed-tea, milk, white of egg, with water, &c. No chemical antidote is known. Oil was at one time thought to be an excellent remedy; but since the discovery of its being a solvent for the cantharidin, suspicion has been entertained that it is calculated to increase, rather than decrease, the patient's danger. This theoretical and plausible objection, first broached, I believe, by Pallas, seems supported by experience. Orfila found that cantharides macerated in cold oil, and afterwards given to dogs, killed them in a few minutes; and Dr. Christison says, "The case mentioned in the Genoa Memoirs was evidently exasperated by the use of oil." I confess, however, I think farther experience is required to determine the hurtful consequences of employing oil; for,—as the editors of the "*Dictionnaire de Matière Médicale*" very properly observe,—on the same principle that oil is prohibited, mucilaginous drinks ought also to be proscribed, since cantharidin, aided by the yellow matter, dissolves in water; and, on the other hand, oil, in some cases, has appeared to be beneficial.[2] To counteract the effects of cantharides, blood-letting, both general and local, opium, and the warm-bath must be resorted to. Camphor was at one time highly esteemed for counteracting the effects of cantharides. Oleaginous and mucilaginous injections into the bladder are recommended to relieve the vesical symptoms.

1. **ACETUM CANTHARIDIS** (*Epispasticum*) L.; *Acetum Cantharidis*, E.; *Vinegar* (*epispastic*) *of Cantharides*; *Acetum Cantharidis*, D. (Cantharides, rubbed to powder, ℥ij.; Acetic Acid, Oj. Macerate the cantharides with the acid for eight days, occasionally shaking: lastly, express and strain, *L.*—"Cantharides, in powder, ʒiij. Acetic Acid, f℥v.; Pyroligneous Acid, f℥xv.; Euphorbium, in coarse powder, ℥ss. Mix the acids, add the powders, macerate for seven days, strain and express strongly, and filter the liquor," *E.*—Spanish Flies, in fine powder, ℥iv.; Strong Acetic Acid, f℥iv.; Acetic Acid of commerce, (sp. gr. 1044),

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[1] See *Journal de Chimie Médicale*, *Août*, 1856, p. 456.

[2] [Recent experiments, elsewhere related, *ante*, p. 747, show that oil is a powerful solvent of cantharidine; hence it would be likely to facilitate absorption and aggravate the symptoms. —Ed.]

f℥xvj. Mix the acids, and, having added the flies, macerate in a close vessel for fourteen days; then strain through flannel with expression, and filter, so as to obtain a clear liquor, *D.*)—Not fitted for internal employment. Applied to the skin as a convenient and prompt vesicant. In the formula of the London College, eight times as much cantharides are employed as in the tincture. [It has been pointed out by Mr. Procter that cold acetic acid is not a good solvent of cantharidin, while warm or boiling acetic acid readily dissolves it. He considers that the preparation would be much improved if the flies were digested for an hour in a glass vessel in acetic acid at about 212°. Probably the cold acid was ordered on the supposition that cantharidin was a highly volatile principle as described by Robiquet.[1]—ED.]

2. **TINCTURA CANTHARIDIS,** L. E. D.; *Tinctura Lyttæ; Tincture of Cantharides.* (Cantharides, in powder, ʒiv.; Proof Spirit, Oij. Macerate for seven [fourteen, *D.*] days, [strain and express strongly the residuum, *E.*] express, and filter, *D.* "This tincture may be obtained much more conveniently and expeditiously by percolation, provided the cantharides be reduced to coarse powder, and left with a little of the spirit in a state of pulp for twelve hours before the process of percolation is commenced," *E.*)—The strength of this preparation is now uniform in the three British Pharmacopœias.—Dose ♏x., gradually increased to fʒj. Its effects on the bladder must be carefully watched. It should be given in some demulcent liquid, as barley water or linseed tea. It is sometimes employed externally as a rubefacient.

3. **CERATUM CANTHARIDIS,** L.; *Unguentum Cantharidis,* E.; *Cerate of Cantharides.* (Cantharides, in very fine powder, ℥j.; Spermaceti Cerate, [Resinous Ointment, *E.*] ℥vj. [℥vij. *E.*] Add the cantharides to the cerate, softened by heat, and mix.)—This preparation must not be confounded with the next one, than which it is more irritant. The uses of the two are the same. From the greater activity of the cerate more danger of the absorption of the active principle of the cantharides is to be apprehended. When this occurs the bladder becomes affected, and, in some cases, inflammation of the absorbents, and fever, are produced.

4. **UNGUENTUM INFUSI CANTHARIDIS,** E.; *Unguentum Cantharidis,* L. D.; *Ointment of Cantharides.* (Cantharides, in very fine powder, ℥iij.; Distilled Water, f℥xij.; Resinous Cerate, lb. j. Boil the water with the cantharides down to one-half, and strain. Mix the cerate with the strained liquor, then evaporate the mixture to a proper consistence, *L.*—"Cantharides, in moderately fine powder, Resin, and Bees' Wax, of each, ℥j.; Venice Turpentine and Axunge, of each, ℥ij.; Boiling Water, ℥v. Infuse the cantharides in the water for one night, squeeze strongly, and filter the expressed liquid. Add the axunge, and boil till the water is dispersed. Then add the wax and resin; and, when these have become liquid, remove the vessel from the fire, add the turpentine, and mix the whole thoroughly," *E.*—Liniment of Spanish Flies, f℥viij.; White Wax, ℥iij.; Spermaceti, ℥j. Melt the wax and spermaceti in the oil with a gentle heat, and stir the mixture constantly until it concretes, *D.*)—A

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[1] *Pharmaceutical Journal*, vol. xii. p. 291.

milder and less certain preparation than the preceding. Used to excite a purulent discharge from blistered surfaces, and to stimulate issues and indolent ulcers.

5. **EMPLASTRUM CANTHARIDIS**, L. E. D.; *Emplastrum Lyttæ; Plaster of Cantharides; Blistering Plaster.* (Cantharides, in very fine powder, lb. j.; Wax, Lard, of each, ℥viiss.; Resin, ℥iij.; Lard, ℥vj. *L.*—Cantharides, in very fine powder, Resin, Bees' Wax, and Suet, of each, ℥ij. *E.*—Cantharides, in very fine powder, ℥vj.; Yellow Wax, Resin, and Lard, of each ℥iv. *D.*—"Liquefy the fats, remove from the heat, sprinkle in the cantharides in very fine powder, and stir briskly, as the mixture concretes on cooling.")—Dishonest druggists sometimes omit a portion of the cantharides here ordered, and substitute powdered euphorbium. In making blistering plasters, care must be taken not to add the cantharides while the melted lard is quite hot, as the heat greatly injures the vesicating power of the insect. For a similar reason the plaster should be spread by the thumb, a heated spatula being objectionable. To prevent the blister moving after its application to the skin, its margin should be covered with adhesive plaster. In order to guard against any affection of the urinary organs, place a piece of thin book-muslin or silver (tissue) paper between the plaster and the skin. The efficacy of the blister depends on the fatty matter dissolving the cantharidin and transuding through the muslin or paper. Some recommend the paper to be soaked in oil, which is supposed to dissolve the cantharidin. Now oil, not being miscible with the blood, is not readily absorbed; and hence, it is supposed, arises its protective influence. The usual time requisite for a blistering plaster to remain in contact with the skin is twelve hours; the vesicle is then to be cut at its most depending part, and dressed with spermaceti ointment. When the irritation caused by these plasters is excessive, it is sometimes necessary to substitute a poultice for the ointment. When we wish to make a perpetual blister, the cerate of cantharides is employed as a dressing; or if we wish to excite less irritation, and prevent the possibility of the urinary organs being affected, the cerate of savine. The danger of applying blisters to children after exanthematous diseases, especially measles, has been already noticed.

6. **EMPLASTRUM CANTHARIDIS COMPOSITUM**, E.; *Compound Plaster of Cantharides.* (Venice Turpentine, ℥ivss.; Burgundy Pitch and Cantharides, of each, ℥iij.; Bees' Wax, ℥j.; Verdigris, ℥ss.; White Mustard Seed and Black Pepper, of each, ʒij. Liquefy the wax and Burgundy pitch, add the turpentine, and, while the mixture is hot, sprinkle into it the remaining articles previously in fine powder, and mix together. Stir the whole briskly, as it concretes in cooling, *E.*)—"This is supposed to be an infallible blistering plaster. It certainly contains a sufficient variety of stimulating ingredients."[1]

7. **EMPLASTRUM CALEFACIENS**, D.; *Warming Plaster.* (Plaster of Cantharides, lb. ss.; Burgundy Pitch, lb. vss. Melt them with a steam or water bath, and, withdrawing the heat, stir constantly until the mixture stiffens.)—Stimulant, rubefacient, and, in some cases, vesicant. Used in catarrh, local pains, &c.

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[1] Duncan, *Edinburgh Dispensatory.*

[8. **LINIMENTUM CANTHARIDIS**, U. S. This is a solution of cantharides in essential oil of turpentine; the proportions being one ounce of flies to eight fluidounces of oil of turpentine.]

9. **PANNUS VESICATORIUS**; *Blistering Cloth; Taffetas Vesicant.* (Digest powder of cantharides in sulphuric ether. Let the ethereal tincture be submitted to distillation, and the residue evaporated, by means of a salt water bath, until ebullition ceases. The oily mass which remains is to be melted with twice its weight of wax, and spread on cloth prepared with waxed plaster,[1] [or on waxed paper or linen] *Henry and Guibourt.*[2]) —Employed as a substitute for the ordinary blistering plaster, than which it is a more convenient and elegant preparation.

The *Tela vesicatoria* or *Blistering Tissue*, and *Charta Vesicatoria*, or *Blistering Paper*, are analogous preparations.

The *Papier épispastique* or *Epispastic Paper* of Henry and Guibourt is prepared as follows:—Take of white wax 8 parts, spermaceti 3 parts, olive oil 4 parts, turpentine 1 part, powder of cantharides 1 part, and water 10 parts. Boil slowly for two hours, constantly stirring it. Strain the fatty mixture through a woollen cloth, without expression, and spread on paper.

[10. **CANTHARIDAL COLLODION.** This preparation, proposed by M. Ilisch, has been much used as a vesicant in the United States. Mr. Procter remarks that it has sometimes failed, either from a deficiency of cantharidin or from want of a sufficient body in the collodion vehicle. It has been found in preparing it to be more advantageous to treat the cantharides with ether until exhausted, distil off the ether, and add the oily residue to collodion of the proper consistency. This is an efficient preparation, and is used by spreading it on paper with a brush and applying to the skin. Nearly all the French preparations contain a direction for digestion of from two to six hours, showing that the opinion of pharmaceutists is opposed to the opinion that cantharides is a very volatile substance even at common temperatures.[3]—ED.]

OTHER COLEOPTEROUS VESICANTS.

In Europe the ordinary vesicating insect is the *Cantharis vesicatoria*; but in some other parts of the world other blistering insects are employed. Thus, *Cantharis vittata*, or the *Potato-fly*, *C. atrata*, *marginata*, and *cinerea*, are used in North America. In the Brazils, *C. atomaria* has been employed. *C. ruficeps*, a native of Sumatra and Java, is said to possess extraordinary blistering properties. *C. gigas* (*Lytta cærulea*, Pfaff), is a native of Guinea and the East Indies. *C. violacea* (*Lytta gigas mas*, Buchner), is a native of the East Indies. In Arabia, *C. syriaca* (*Lytta segetum*), is said by Förskal to be employed. *Malabris Cichorii* is used in China and some parts of the East Indies. *Meloe proscarabæus* is an indigenous vesicating insect which has in two instances caused death. *M. majalis* or *true Mayworm* possesses similar properties.

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[1] The *Toile preparée à la cire*, used by the French pharmacologists, is prepared by spreading the following mixture on cloth: — white wax 8 parts, olive oil 4 parts, and turpentine 1 part (Henry and Guibourt).

[2] *Pharmacopée Raisonnée*, 3me édit. p. 470, Paris, 1841.

[3] *Pharmaceutical Journal*, loc. cit.

ORDER II. HEMIPTERA.—*Linnæus.*

CHARACTERS.—2 *wings* covered by *elytra*. *Mouth* formed for suction; the *rostrum* composed of a tubular articulated sheath, including four scaly setæ, in place of mandibles and jaws. *Elytra*, in some, crustaceous, with the posterior extremity membranous; in others, almost similar to wings, but more extended, thicker, and coloured (Stark).[1]

375. COCCUS CACTI, *Linn. L. E. D.*—COCHINEAL INSECT.

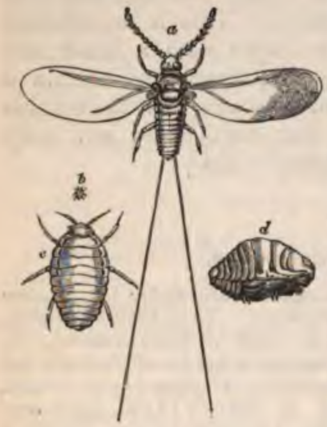
(Coccus, *L.*—The entire insects, *E. D.*)

HISTORY.—The Spaniards, on their first arrival in Mexico, about the year 1518, saw the cochineal employed (as it appears to have been long before) by the native inhabitants of that country, in colouring some part of their habitations and ornaments.[2]

ZOOLOGY. **Gen. Char.**—*Tarsi* with 1 joint, and terminated by a single hook. *Male* destitute of a *rostrum*, with 2 wings covering the body horizontally; abdomen terminated by 2 *setæ*. *Female* apterous, furnished with a rostrum. *Antennæ* of 11 joints, filiform, and setaceous.

Sp. Char.—*Male* very small, with the *antennæ* shorter than the body: *body* elongated, of a deep red, terminating by two long, diverging *setæ*; *wings* large, white, crossed above the abdomen. *Female* nearly twice as large as the male, bluish red, covered with a white farina; *antennæ* short; *body* flattened below, convex, *feet* short.

FIG. 120.



Cochineal Insects (*male and female*).

a. Male, with the wings, expanded.
b. Adult female (natural size).
c. Adult female (magnified).
d. Impregnated female (natural size).

Wings of the male beautifully snow white. The females fix themselves firmly on the plant, which serves them as a habitation, and never quit this spot: here they couple, and increase considerably in size. Each insect lays several thousand eggs, which proceed through an aperture placed at the extremity of the abdomen, and pass under the belly to be there hatched. Death then ensues; the body of the mother dries up; its two membranes become flat, and form a sort of shell or cocoon, in which the eggs are inclosed, and from whence the little cochineals soon proceed. The female only is of commercial value.

Hab.—Mexico.

CULTIVATION.—The cochineal insects

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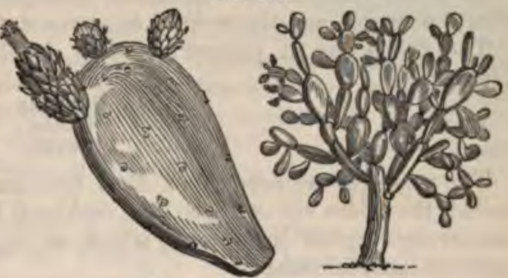
[1] *Elements of Natural History*, ii. 318.

[2] Bancroft, *Experimental Researches*, i. 413; and Beckmann, *History of Inventions*, ii. 192.

feed on the *Nopal* (*Opuntia cochinillifera*).[1] Mr. Ward[2] says the plantations are confined to the district of La Mīstĕca, in the state of Oăxācă, in Mexico. The animals are domesticated and reared with the greatest care. Plantations of these are cultivated for the nourishment of the insects. Here the impregnated females are placed; this operation being denominated *sowing*. Young ones are soon developed; and some months afterwards, when the females have become fecundated and enlarged, the harvest commences. The insects are brushed off with a squirrel's tail, and killed by immersing them in hot water, and afterwards drying them in the sun, or by the heat of a stove. Three harvests are made annually; the first being the best, since the impregnated females alone are taken; in the second the young females also are collected; and in the third both old and young ones, and skins, are collected indiscriminately. Before the rainy season commences, branches of the nopal plant, loaded with infant insects, are cut off and preserved in the houses of the Mexicans, to prevent the animals being destroyed by the weather.

FIG. 121.



Opuntia cochinillifera.

COMMERCE.—In 1839, the quantity of cochineal on which duty (1s. per cwt.) was paid, was 489,988 lbs. In 1838 it was only 204,748 lbs. It is said that, on the average, one pound of cochineal contains 70,000 dried insects. [The importations in the ten years from 1835 to 1844 amounted to 55,523 serrons, of which 32,573 were taken for exportation, and 22,950 for home consumption, giving an annual consumption of 2295 serrons at that period. The importations have much increased of late years, as the following statement will show. There were imported:—

	Bags.		*Bags.*
In 1851	16,561	In 1853	6,906
1852	14,885	1854	12,876

and for the year ending January 5, 1853, there were imported 8964 cwts.

Among the sources of productive importation of this article, Teneriffe must now be named, this island producing several thousand bags per annum, although the cultivation of the insects there is comparatively recent, *i. e.* having commenced within the last twenty years.

The weight of a serron of cochineal varies according to the country of production. Thus the weight of a serron from

Honduras	is about	150lb.	to	160lb.
Mexico	„	190lb.	„	200lb.
Teneriffe	„	120lb.	„	170lb.

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[1] *Cactus cochinillifer*, Linn., is without spines, and is called *Spineless Cochineal*:—this does not produce the best Mexican Cochineal. De Candolle has given as *C. coch.* the *C. Tuna* of Linnæus,—a plant totally distinct. *Cactus Tuna* yields the cochineal of Mexico. *C. cochinillifer* also yields *Opuntia maxima.*—Sloane, vol. ii. p. 152, t. 8, f. 1 and 2.

[2] *Mexico in* 1827, i. 84.

The last description, which varies so much in weight is in fact not brought in in serrons at all, although from habit the package is often styled serron; they have no hides in Teneriffe to pack the cochineal in bags.

As to the Honduras and Mexican descriptions, the import package is always a serron, and the weight, as above stated, very uniform.

The proportion at present (January, 1857) in our warehouses is as follows:—

4891	Bags Honduras.
567	„ Mexican.
1401	„ Teneriffe.

The packages are here called *Bags* because as soon as the serrons are loaded, the hides are cut open, the cochineal is then sifted and repacked into strong English linen bags, which on exportation are packed into casks or cases for safety.

Serrons of cochineal are imported, but *bags* are exported.—Ed.]

Description.—Cochineal (*coccus; coccinella*) consists of the dried female insects, which are about one or two lines long, wrinkled, of an irregular figure, convex on one side and flat or somewhat hollow on the other. They are inodorous, have a bitterish warm taste, tinge the saliva violet red, and yield a dark red powder. In burning they evolve an animal odour, and leave a greyish white ash. By infusion in water they swell up, show their ringed character, and even their feet, giving the liquid a red colour. Both the Honduras and Vera Cruz kinds are distinguished into the silver and black varieties. *Silver cochineal* (*cochinilla jaspeada* of the Spaniards) has a purplish grey colour; but in all the furrows and depressions we observe a whitish powder, which, examined by the aid of a lens, appears like fine wool. *Black cochineal* (*cochinilla renigrida* or *grana nigra* of the Spaniards), is reddish or purplish black, and devoid or nearly so of the silvery character. *Granilla* (*cochinilla sylvestre* or *grana sylvestria*) consists of very small cochineal insects, and smaller, wrinkled, globular or ovate masses, (cocoons and new-born insects ?) somewhat like fragments of the cochineal insect.[1]

An extensive system of adulterating cochineal by a mercantile house in London was discovered a few years ago. The genuine article was moistened with gum-water, and then agitated in a box or leathern bag, first with powdered sulphate of baryta, then with bone or ivory-black, to give it the appearance of black cochineal. By this means the specific gravity of the cochineal was increased from 1·25 to 1·35, and 12 per cent. of worthless heavy spar sold at the price of cochineal.[2] Powdered talc and carbonate of lead have been used to give it a silvery appearance. But a lens will readily distinguish these powders from the real wool which gives the true silvery character.

[*Cake Cochineal.* Dr. Stark has described under this name a substance brought from Cordova, in South America. It was there sold as a red dye stuff. He found it to be soluble in water, and the colouring matter taken up by water, had all the usual properties of a cochineal dye.

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[1] See *Granillo*, in Bancroft's *Experimental Researches*, i. 435.

[2] Ure, *Dictionary of Arts and Manufactures*, p. 305–6.

There were found mixed with the cake, some of the strong thorny spines of the cactus opuntia. The result of his investigation was that the cake was a mass of cochineal insects collected when the females were full of ova, and containing others in which the ova had become developed and escaped from the mother-cell or insect. This last-mentioned fact accounted for its inferiority to cochineal as a colour-producing compound; since, whether in relation to lac, kermes, or cochineal, the largest quantity of colouring matter is yielded by the mother-insect before the eggs are fully developed, and but little colouring matter is yielded by those insects in which the eggs are fully developed or are hatched. It was more costly in Cordova than the best cochineal in this country: hence it is not likely to replace it.[1]—Ed.]

Composition.—Two analyses of cochineal have been made; one by John,[2] the other by Pelletier and Caventou.[3] The latter chemists found the constituents to be *carmine*, *peculiar animal matter*, *fatty matter* (composed of *stearine*, *olein*, and an *odorous acid*), and *salts* (viz. phosphate and carbonate of lime, chloride of potassium, phosphate of potash, and a salt of potash, containing an organic acid).

Cochenillin (*Carmine*).—Obtained by digesting cochineal in ether, to extract the fatty matter, and then in alcohol, which dissolves the carmine. This colouring matter is a brilliant purplish red substance, with a granular or crystalline appearance; unalterable in the air, easily soluble in water and alcohol, but insoluble in ether. It fuses at 112° F. Chlorine renders it yellow. Acids change its colour. The concentrated mineral acids decompose it. Alkalies render the watery solution of carmine violet. Lime-water forms a violet precipitate with it. The affinity of hydrate of alumina for it is most remarkable: the compound formed by their union is called a *lake*. [*Cochenillin* contains nitrogen, but its formula has not yet been determined. According to Preisser the red colouring matter of the insect, which he calls *Carmeine*, is derived by oxidation from a colourless crystalline compound called by him *carmine*. —Ed.]

The pigment sold in the shops as *carmine*,[4] one of the most valuable colours employed by the painter in water-colours, is a compound, of which cochenillin is one of the constituents. Pelletier and Caventou regard it as consisting of cochenillin, animal matter, and an acid.

Physiological Effects and Uses.—Diuretic, diaphoretic, antispasmodic, and anodyne qualities, have been assigned to cochineal, but without the least evidence of their existence. A mixture of carbonate of potash and cochineal is a popular remedy for hooping-cough. The only real value of cochineal is in the colouring matter, and as such it is used both in powder and solution. In the arts it is extensively employed in dying scarlet and crimson, and in the manufacture of *carmine* and *lake*.

Manufacture of Carmine.—[We subjoin the following note by the author on the manufacture of carmine, evidently the result of his own observation of the process pursued.—Ed.]

Carmine is prepared from *black* cochineal. A decoction of the insect in water is made. The residue is called *carmine grounds* (used by paper-stainers). To the decoction is added a precipitant—say bichloride of tin. Alum will not answer, as the colour is very different. The decoction to which the bichloride has been added is put into wash-hand basins, and allowed to stand. Slowly a deposit takes place. It adheres to the sides of the vessel, and the liquid being poured off, it is dried. Artificial heat cannot be used, as it changes the colour of the deposit; neither can solar light be employed for the same reason. This precipitate when dried is *carmine* [the liquor is called *liquid rouge*]. It can only be made in certain states of weather. If the weather be too hot, the liquids soon become sour, and the deposit is redissolved; yet fine weather is necessary, or the precipitate will not dry: flies also injure it. If carmine be not dry, it is apt to become mouldy.

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[1] [*Pharmaceutical Journal*, vol. xiv. p. 346.]

[2] Gmelin, *Handb. der Chem.* ii. 1474.

[3] *Ann. de Chim. et de Phys.* viii. 250.

[4] *Carmine*, sold by the perfumers as *Rouge*, is very different from jewellers' *rouge* (oxide of iron). The carmine sold for theatrical performers must be largely diluted, as it has been sold at 10s. per ounce, when carmine, properly so called, was worth £3 or £4 per ounce.

The decoction from which the carmine has been precipitated yields a further precipitate on the addition of more of the precipitant: but the product thus obtained is darker coloured, and is sold to the colour makers as *lake*. It varies considerably in its tint.

Carmine is quite soluble in ammonia. Its colour should be remarkably bright. It should be also in the form of a light powder. These are the best tests of its goodness. *Carmine* is used for velvet painting, for pattern drawing for waistcoats, for water-colour painting, and as a face paint. Lady Dungannan's composition is composed of carmine, with a little water and ammonia. According to Bateman *rouge for the face* is made by mixing lb. ss. of levigated French chalk and 2 oz. of fresh carmine.

Six drachms of carmine may be obtained from 1 lb. of cochineal.

Cochineal is sometimes used for colouring pickled cabbage.

Cochineal colouring for jellies, &c. is prepared by adding cream of tartar to a decoction of cochineal, and filtering. The pink saucers sold in colour shops are made up with a mixture of carmine, gum, and ammonia.

1. **TINCTURA COCCI CACTI**, D. (Take of Cochineal, in fine powder, ℥ij.; Proof Spirit, Oj. Macerate for fourteen days, strain, express, and filter.)

[The author has recommended the following proportions for the tincture of cochineal:—Cochineal, in powder, one part; Rectified Spirit, eight parts. Macerate for eight days, then filter.—ED.

2. **SYRUPUS COCCI**, L. Take of Cochineal, bruised, four scruples; Distilled Water, boiling, a pint; Sugar, three pounds, or as much as may be sufficient; Rectified Spirit, two fluidounces and a half, or as much as may be sufficient. Boil the cochineal in the water for a quarter of an hour in a covered vessel, frequently stirring, then strain and finish off as is directed for Syrup of Altheæ. This preparation is simply designed as a colorant. Cochineal is not possessed of any medicinal properties.

[376. COCCUS SINENSIS.

INSECT WAX OF CHINA, PE-LA.—Upon the authority of Sir G. Staunton, the insect from which Chinese wax was derived was considered to be a cicada and described as *cicada* or *flata limbata*. Recent researches have, however, shown that the wax insect is a species of coccus called *Coccus Sinensis*. The insect is reputed to feed on the *Ligustrum lucidum*, but this is doubted by Mr. Fortune. He assigns the plant to some species of ash (*fraxinus*).[1] The wax insect is chiefly found in the province of Sze-tchuen. In form it is not unlike the oval wood-louse. The crude wax is deposited by the insects, around the branches of the tree on which they feed, as a white soft fibrous velvety coating of from one to two-tenths of an inch in thickness. The deposit therefore takes place under circumstances very similar to those in which lac resin is met with.

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[1] [See *Pharmaceutical Journal*, vol. xii. p. 480, also p. 74. At the former reference Mr. Daniel Hanbury has given a full account of the production of this remarkable substance.]

According to Dr. Macgowan the annual product of this insect in wax is about 400,000 pounds, valued at 100,000 Spanish dollars. At Ningpo, the wax costs from 1*s.* to 1*s.* 6*d.* per pound. Mr. Hanbury states that in 1846–7 three tons of this wax were imported into London. It fetched only 1*s.* 3*d.* per pound, a price too low to be remunerative.

The insect wax occurs in commerce in circular cakes. Some of those imported into London had a diameter of thirteen inches, and a thickness of three and a half inches. The broken surface, according to Mr. Hanbury, exhibits the wax as a beautifully sparkling highly crystalline substance somewhat resembling spermaceti but much harder.

Properties.—The insect wax is colourless, inodorous, or nearly so, tasteless, brittle, and readily pulverisable at a temperature of 60°. It is used by the Chinese as a medicine both externally and internally. It melts at about 180°, is insoluble in water, is only slightly soluble in alcohol or ether, but very soluble in naphtha, from which solution it may be obtained in a crystallised state. It is scarcely saponified by boiling in caustic potash. It contains no nitrogen. Its formula, according to Brodie's analysis, is $C^{108}H^{108}O^{4}$.—ED.]

ORDER III. HYMENOPTERA, *Linnæus*.

CHARACTERS.—4 naked veined *wings* of unequal size. *Mouth* composed of jaws, mandibles, and 2 lips. *Lip* tubular at its base, terminated by a labium, either doubled or folded in, and forming a kind of sucker. *Females* with a compound ovipositor or sting at the anus.

377. APIS MELLIFICA, *Linn. L. E. D.*—THE HIVE BEE, OR HONEY BEE.

(1. Humor florum in favo repositus despumatus, *L.*; Saccharine secretion, *E. D.*—2. Cera, Favus preparatus; Cera alba, idem dealbatus, *L.*; Cera flava, Waxy secretion, Cera alba, Bleached bees' wax, *E.*; Cera alba, Cera flava, *D.*)

HISTORY.—This animal was very anciently known, and is frequently referred to in the Old Testament. In all ages it has been an object of admiration and attention on account of its industry, curious economy, and policy.

ZOOLOGY. **Gen. Char.**—*Labium* filiform, composing with the jaws a kind of *proboscis*, geniculate, and bent downwards. First joint of the posterior *tarsi* large, compressed. No spines at the extremity of the last two *legs*. Upper *wings* with one radial and three cubital cells (Stark).

Sp. Char.—Blackish. *Abdomen* of the same colour, with a transverse greyish band, formed by the down at the base of the third and following segment (Stark).

The honey bee lives in societies, called *swarms*, consisting of from fifteen to thirty thousand individuals. Each swarm is composed of three classes of individuals—viz. a female, males, and neuters. The female, called the *queen bee*, is narrower and longer than the others. The males, termed *drones*, are smaller than the females, and are devoid of stings. In each hive there are from 800 to 1000 drones. Towards autumn, when they can be of no further use, they are destroyed by the neuters. The neuters are termed *working bees*, and are by far the most numerous, since in each hive there are from fifteen to twenty thousand. They are in reality females, whose ova are not developed, in consequence, as some have supposed, of the nature of the aliment with which they are supplied while in the larva state.

The DIGESTIVE SYSTEM of the animal consists of highly developed *solitary organs* communicating with the proboscis, of an *œsophagus* (which enlarges at one part, forming the *crop*, *sucking stomach*, or *honey bag*), *a proper stomach*, *small* and *large intestines*, and *biliary vessels*. The latter open into the alimentary canal immediately behind the stomach. The SEXUAL SYSTEM, in the *male*, consists of *a pair of testicles*, each having a *vas deferens*, which terminates in a *vesicula seminalis*. From the conjoined extremities of the vesiculæ proceed *a common duct* terminating in a *penis*. The *female genital organs* consist of *two ovaries* made up of tubes, each containing about twelve *ova*; the *two oviducts* from these ovaries terminate in a *vagina*, into which also opens a *duct* from *a roundish vesicle*. The POISON APPARATUS is found in the females and neuters only. It consists of *two thin convoluted secreting organs*, opening into a *pyriform receptacle*, from which *a small duct* passes to the *sting*, which consists of two portions placed side by side, barbed at the extremity and contained in a sheath. The *poison* is said to be hot and acrid to the taste. The consequences produced by the sting of a bee are pain, redness, swelling, and hardness of the part; and might prove fatal if a swarm were to attack an individual. The removal of the sting (if left within the wound), and friction with saliva, or with oil and hartshorn, is all the treatment usually required. [The poison has a strongly acid reaction.—ED.]

Hab.—Old continent (Latreille). In a state of nature they reside in hollow trees; but they are almost universally domesticated, and are preserved in *hives*. Curtis[1] has described and depicted a remarkable instance of the nest of some hive bees attached to the arm of a tree. It was discovered in 1838, by Lord Malmesbury, in his plantation near the river Avon.

Bees furnish two products useful in medicine,—viz. *honey* and *wax*.

α. HONEY. PRODUCTION.—Honey (*mel*) is secreted by the nectariferous glands of flowers, and is collected by the working or neuter bees, who take it by suction or lapping, and pass it into the dilatation of the œsophagus, denominated *crop*, *sucking stomach*, or *honey-bag*; beyond which, we presume, the honey does not pass, as it has never been found in the true stomach. When the animal arrives at the hive, the honey is disgorged by a kind of inverted peristaltic motion, and is probably somewhat altered in its properties by the secretions of the crop. It is used by the animal as food.

PHYSICAL PROPERTIES.—Honey varies in its taste and odour according to the age of the bees and flowers on which they have fed. A hive which has never swarmed is considered to yield the best, which is therefore called *virgin honey*. The flavour of Narbonne honey, which is so much admired, is said to arise from the labiate flowers on which the animals feed; to imitate this a sprig of rosemary is sometimes added to the honey obtained from other places.

PURITY.—Flour, it is said, is now and then mixed with honey. This adulteration may be readily distinguished by its insolubility in cold water, and by the blue colour produced by the addition of iodine.

The London College directs that honey,—

Is not to be employed without being despumated. Dissolved in water, iodide of potassium and nitric acid being added, it does not become of a blue colour.

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[1] *British Entomologist*, xvi. pl. 799.

CHEMICAL PROPERTIES.—The constituents of honey vary somewhat according to the food of the bees, the season, the age of the animals, the mode of extracting it from the combs, &c. It must, however, be regarded at all times as a concentrated solution of *sugar*, mixed with *odorous*, *colouring*, *gummy*, and *waxy* matters. The saccharine matter is of two kinds: one crystallisable, and analogous to the sugar of grapes; the other uncrystallisable, and similar to the uncrystallisable brown syrup of the sugar-cane. Guibourt has found also mannite, which differs from sugar in not fermenting when mixed with water and yeast.

PHYSIOLOGICAL EFFECTS.—Honey is emollient, demulcent, nutritive, and laxative. When fresh it is apt to occasion indigestion and colic. Collected from poisonous plants, it has been found to possess deleterious qualities. The honey of Trebizond has long been notorious for its deleterious qualities. Mr. Abbott[1] says it causes violent headache, vomiting, and a condition like that of a tipsy man. A larger dose produces deprivation of all sense and power for some hours afterwards. These effects agree with those assigned to this honey by Xenophon[2] in his account of the "Retreat of the Ten Thousand." Pliny[3] also speaks of this poisonous honey. Tournefort[4] ascribes its venomous properties to the bees feeding on the *Azalea pontica*. Many other instances of poisonous honey are on record.[5]

USES.—Mixed with flour, and spread on linen or leather, it is a popular application to promote the maturation of small abscesses and furunculi. It sometimes forms a constituent of gargles, partly on account of its taste, partly for its emollient operation. It is also used as a vehicle for the application of other more powerful agents to the mouth and throat, especially in children. It is occasionally employed as an emollient and demulcent in inflammatory affections. In troublesome coughs, barley-water, mixed with honey, and sharpened with slices of lemon, and taken warm, forms a very agreeable and useful demulcent to allay troublesome coughs.

1. MEL DEPURATUM, D.; *Clarified Honey*. (Melt the honey in a water bath, and strain it while hot through flannel.)—The object of this process is to deprive honey of certain impurities which render it apt to ferment; but the flavour and odour of the honey are somewhat injured by the operation.

2. OXYMEL.—See *ante*, p. 502.

β. WAX. SECRETION OF BEES' WAX.—Bees' Wax (*cera*) was at one time supposed to be merely the pollen of plants elaborated by bees. Bonnet, however, so early as 1768, asserted it to be a secretion from the ventral scales. Hunter[6] and Huber have subsequently proved the correctness of this assertion. The latter writer, indeed, proved that the pollen is not at all essential to the production of wax, for bees fed on honey and water equally secreted it, and formed the usual waxy cells. With this wax they construct the *comb* (*favus*), the cells (*alveoli*) of which are hexagonal with angular bottoms.[1] The substance called *Propolis* is collected by the bees from the buds of trees. It is of a resinous nature, and is used for lining the cells of a new comb, stopping crevices, &c.

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[1] *London and Edinburgh Philosophical Magazine* for October 1834, vol. v. p. 313.

[2] *Anabasis*, lib. iv.

[3] *Hist. Nat.* xxi. 44, ed. Valp.

[4] *Hist. de l'Acad. Roy. des Sciences*, p. 351, 1704.

[5] See Barton, *Philosophical Magazine*, xii. 121; and in Beck's *Medical Jurisprudence*: also Hamilton's *Travels in Asia Minor*, 1842.

[6] *Philosophical Transactions* for 1792, p. 143.

PREPARATION.—Wax is extracted from the comb, partly by allowing the latter to drip, partly by subjecting it to pressure. The comb is then melted in water, by which the impurities subside, and the wax is allowed to cool in moulds.

PROPERTIES OF YELLOW BEES' WAX.—Yellow wax (*cera flava*) has a remarkable and peculiar odour; its colour is more or less yellow, but varying in degree; its specific gravity varies from 0·960 to 0·965. [It melts at 145°.—ED.] It is said to be sometimes adulterated with suet, which gives it a fatty and disagreeable taste. Resin may be recognised by its solubility in cold alcohol; bean or pea meal, by its insolubility in oil of turpentine.

WAX BLEACHING.—This is effected by melting yellow wax (either in a copper vessel, or in a large vat or tub, by means of steam), running it off, while in the melted state, into a trough, called a *cradle*, perforated at the bottom with holes, and placed over a large water-tank, at one end of which is a revolving cylinder, almost wholly immersed in water. By this means the wax is solidified, converted into a kind of ribbon, and conveyed on the surface of the water to the other end of the tank. These ribbons of wax are here lifted out, and conveyed in baskets to the bleaching grounds, where they are exposed to the air for one or two weeks (according to the state of the weather), being turned every day, and watered from time to time. The wax is then re-melted, re-ribboned, and re-bleached; it is subsequently refined by melting in water acidulated with sulphuric acid.

PROPERTIES OF WHITE WAX.—White wax (*cera alba; cera dealbata*) is yellowish white: I have never met with pure wax perfectly white. The circular cakes of commerce, as well as wax candles, always contain spermaceti, which the dealers add to improve the colour. Pure wax is solid, brittle, inodorous, or nearly so, insipid, fusible, and at a much higher temperature decomposable. Its specific gravity varies from 0·8203 to 0·965. [It melts at 158°, and congeals at 149°.—ED.]

COMPOSITION.—According to John, wax is a compound of two other substances;—the one called *cerine*, the other *myricine*. [The former is soluble in alcohol, the latter is comparatively insoluble.—ED.] These have been examined by Boudet and Boissenot.[2]

1. CERINE.—This constitutes at least 70 per cent. of wax. It fuses at 143½° F. It dissolves in 16 parts of boiling alcohol. By saponification with potash it yields margaric acid, a minute portion of oleic acid, and a considerable quantity of a non-saponifiable fat called *ceräine*.

2. MYRICINE.—It fuses at 149° F. It dissolves in 200 parts of boiling alcohol of

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[1] On their mathematical form, consult Waterhouse, in the *Penny Cyclopædia*, art. *Bee*; and Lord Brougham's *Dissertations on Subjects connected with Natural Theology*, i. 218, 1839.

[2] *Journ. de Pharm.* xiii. 38.

sp. gr. 0·833. It is not saponifiable by potash. Ettling[1] says that cerine, ceraine, and myricine, are isomeric, and composed of $C^{19}H^{19}O$. More recently Hess[2] asserts that pure wax is homogeneous, and possesses the properties of myricine; its composition being $C^{20}H^{20}O$. The difference between cerine and myricine he ascribes to the presence of *ceric acid* formed by the oxidation of myricin.

[Mr. B. C. Brodie has made an extensive series of researches into the constitution of wax, and has assigned formulæ to sixteen different constituents or products of the decomposition of wax. He applies the name cerotic acid to cerine, and represents its formula as $C^{54}H^{54}O^{4}$. Pure myricine he considers to be represented by $C^{92}H^{92}O^{4}$.[3] It is remarkable that in nearly all the varieties of wax, as well as in the products obtained from this body, the carbon and the hydrogen are in equal equivalents. Bees' wax varies very much in the proportions of cerine and myricine which it contains. Wax is obtained from the vegetable kingdom.—ED.] (See *ante*, p. 762).

PHYSIOLOGICAL EFFECTS AND USES.—Wax is an emollient and demulcent. It has been administered internally, in the form of emulsion (prepared with melted wax and soap, yolk of eggs, or mucilage), in *diarrhœa* and *dysentery*, especially when ulceration of the alimentary canal is suspected. In these cases it has been used by Hufeland and Wedekind. It has sometimes been employed as a *masticatory;* but its action is mechanical only. Its principal use, however, is *externally*, sometimes as a mild sheathing or protecting application, sometimes as a basis for the application of other agents. It is a constituent of all *cerates*, which take their name from it. The vapour evolved from wax placed on red-hot iron has been inhaled in phthisis.

1. **EMPLASTRUM SIMPLEX**, E.; *Emplastrum attrahens; Wax Plaster.*—Bees'-wax, ℥iij. Suet, and Resin, of each, ℥ij. "Melt them together with a moderate heat, and stir the mixture briskly till it concretes on cooling," *E.*—Used to promote discharge from a blistered surface.

[The **EMPLASTRUM AROMATICUM** of the former *Dublin Pharmacopœia* was thus prepared:—Frankincense [*Thus*], ℥iij.; Yellow Wax, ℥ss.; Cinnamon Bark, powdered, ʒvj.; Essential Oil of Allspice; Essential Oil of Lemons, of each, ʒij. Melt the Frankincense and Wax together, and strain; when they are beginning to thicken by cooling, mix in the powder of cinnamon rubbed up with the oils, and make a plaster."—By keeping, as well as by the application of heat in spreading, the volatile oils of this preparation are dissipated. "It is used as a stimulant, applied over the region of the stomach, in dyspepsia and increased irritability of that organ, to allay pain and nausea and expel flatus."—ED.]

2. **CERATUM**, L.; *Unguentum simplex*, E.; *Unguentum Ceræ albæ*, D.; *Simple Cerate; Simple Dressing.* (Olive Oil, Oj. [f℥vss. *E.*]; Wax, ℥xx. [White Wax, ℥ij. *E.*], White Wax, lb. j.; Prepared Hog's Lard, lb. iv. *D.* Add the oil to the melted wax, and mix [and stir the mixture

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[1] Thomson, *Organic Chemistry.*
[2] *Pharm. Central-Blatt für* 1838, p. 332.
[3] *Philosophical Transactions* for 1849, p. 106.

briskly while it concretes on cooling, *E.*])—A mild and cooling dressing. Sometimes used as a basis for more active preparations.

3. **LINIMENTUM SIMPLEX**, E.; *Simple Liniment.* (Olive Oil, *four parts*; White Wax, *one part.* Dissolve the wax in the oil with a gentle heat; and agitate well as the fused mass cools and concretes.)—Differs from the *Unguentum simplex* in its greater liquidity. Used to soften the skin, and to promote the healing of chaps.

[4. **GLYCERINE OINTMENT.** Take of spermaceti ℥ss.; White Wax ʒj.; Oil of Almonds ℥ij. (f); Glycerine ℥j (f). Melt the wax and spermaceti with the oil of almonds at a moderate heat, put them into a Wedgwood mortar, add the glycerine, and rub until well mixed and cold. Useful for chapped hands. — Ed.]

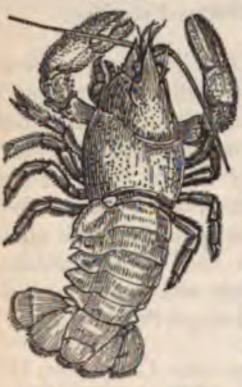
OTHER HYMENOPTEROUS INSECTS.

The tribe of hymenopterous insects, called *Gallicolæ* or *Diploleparia*, contains the insects which produce those excrescences on plants commonly denominated *galls* (see *Nutgall*, and *Bedeguar*). Latreille[1] comprehends all the insects of this tribe in one genus,—viz. *Cynips*.

Class VII. Crustacea, *Cuvier.*—Crustaceans.

The dietical properties of the Crustaceans (Lobsters, Crabs, Cray-fish, Prawns, and Shrimps), have been noticed in a former part of the work.

Fig. 122.



Astacus fluviatilis.

1. Astacus fluviatilis.—In the stomach of the *Crawfish* are found, at the time the animal is about to change its shell, two calcareous concretions, commonly called *Crabs' Eyes* or *Crabs' Stones* (*Lapilli Cancrorum*), which were formerly ground and employed in medicine, as absorbents and antacids, under the name of *Prepared Crabs' Stones* (*Lapilli Cancrorum præparati; Lapides Cancrorum præparati; Oculi Cancrorum præparati*).[2] They consist of carbonate of lime and animal matter principally, with a little phosphate of lime. Their use is now obsolete. In the shops, imitations of them (prepared with chalk and mucilage, or size) are still met with.

2. Cancer Pagurus.—The *Black-clawed or Large Edible Crab* was at one time an officinal animal. Its *Claws* (*Chelæ Cancrorum*), when prepared by grinding, constitute the *Prepared Crabs' Claws* (*Chelæ Cancrorum præparatæ*) of the shops. Their composition and uses are similar to those of prepared Crabs' stones. I have already given an account of the effects and uses of carbonate of lime.

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[1] In Cuvier's *Règne Animal*, v. 291, 1829.

[2] "Those animals which are ready to moult have always two stony substances, called *crabs' eyes*, placed in the stomach, which, from the experiments of Reaumur and others, appear destined to furnish the matter, or a portion of it, of which the shell is formed; for if the animal is opened the day after its moult, when the shell is only half hardened, these substances are found only half diminished, and if opened later, they are proportionably smaller." —(Kirby, *Bridgewater Treatise*, vol. ii. p. 55; quoted by Bence Jones, p. 79.)

Division II. Vertebrata. Vertebral Animals.

CHARACTERS.—Animals furnished with a *skull* and *vertebral column* for the protection of the brain and spinal marrow.

Class VIII. Pisces.—Fishes.

CHARACTERS.—*Vertebrated* animals with cold red *blood*, respiring by *gills* or *branchiæ*, and moving in the water by the aid of *fins*.

No article of the Materia Medica, contained in the British Pharmacopœias, is derived from this class of animals: but the important uses of *Isinglass*, and the extraordinary efficacy, in various diseases, ascribed by some writers to *Cod-liver oil*, render it necessary to notice both of these productions.

378. ICHTHYOCOLLA.—ISINGLASS.

HISTORY.—Ichthyocolla (*ἰχϑυοκόλλα*, from *ἰχθὺς*, *a fish*; and *κόλλα*, *glue*) is mentioned by Dioscorides[1] and Pliny.[2] The latter of these writers ascribes its invention to Dædalus.

ZOOLOGY.—Isinglass is obtained from various fishes, some only of which have hitherto been ascertained. The finest kinds are procured from different species of *Acipenser*. Several other genera,—as *Silurus*, *Morrhua*, *Gadus*, *Otolithus*, *Lota*, and *Polynemus*, also yield it.

The organ from which isinglass is usually procured is the *air-bag*, or *swimming bladder*, sometimes termed the *sound*. It is a membranous sac filled with air (containing from 69 to 87 per cent. of oxygen), and placed under the spine, in the middle of the back, and above the centre of gravity. In most fish it communicates with the œsophagus, or stomach, by the *ductus pneumaticus*. In others it is an imperforate sac. Occasionally there are two sacs, which communicate with each other. In the Acipenser stellatus, according to Brandt,[3] the bag is composed of three membranes: an external, silvery one, derived from the peritoneum; a middle, membranous (*hautigen*) one; and the most internal, very vascular, and, as it were, pulpy membrane. The latter, he states, yields the fish gelatine. But unless the sound of this fish differs considerably from that of other fishes, there must be an error in this statement. I have examined all the purse and pipe isinglasses of commerce, and find the internal to be an insoluble membrane. In the cod the innermost membrane is very thin, and is perhaps analogous to the epithelium. Externally to this is a highly vascular thin coat, and still more externally is the gelatinous coat, which appears devoid, or nearly so, of vessels.

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[1] Lib. iii. cap. 102.

[2] *Hist. Nat.* lib. vii. cap. 57; and lib. xxxii. cap. 24, ed. Valp.

[3] Brandt and Ratzeburg's *Medicinische Zoologie*, p. 27, Berlin, 1833.

Preparation.—The mode of preparing the swimming bladder for sale as isinglass, varies in different countries. Sometimes the bag is dried unopened, as in the case of the *purse*, *pipe*, and *lump* isinglass of the shops. At other times it is laid open, and submitted to some preparation; being either dried unfolded, as in the *leaf* and *honeycomb* isinglass; or folded, as in the *staple* and *book* isinglass; or rolled out, as in the *ribbon* isinglass. When it arrives in this country it is *picked* or *cut*. Formerly it was picked into shreds by women and children, but it is now usually cut by machines worked by steam.

Description.—Many varieties of isinglass are imported: the Russian kinds are the most esteemed; but the Brazilian, on account of its cheapness, is very extensively used.

1. Russian and Siberian Isinglass.—The isinglass produced in the Russian empire is principally obtained from the sturgeons. These cartilaginous fishes constitute the genus *Acipenser*.

The following are the generic characters of Acipenser:—Body elongated and angular, defended by indurated plates and spines, arranged in longitudinal rows; snout pointed, conical; mouth placed on the under surface of the head, tubular, and without teeth (Yarrell[1]). The species are badly determined. Brandt[2] has described and figured eight. *Acipenser Sturio*, or the *Common Sturgeon*, is occasionally caught in the river Thames. The species from which Isinglass is procured are the following:—

1. A. Huso, Linn. The *Beluga* or *Bielaga*.—Inhabits the Caspian Sea and its tributary streams. Its roe (ovary) is esteemed as *caviare*. Its swimming bladder, when properly prepared, yields *leaf isinglass* of three qualities, *fine firsts*, *firsts*, and *seconds*.

2. A. Guldenstadtii, Brandt and Ratzeburg. The *Ossetr* or *Osseter*.—Inhabits the Caspian and Black Seas and their tributary rivers. *Caviare* is prepared from its roe (ovary). From its swimming bladder are obtained both *staple* and *leaf isinglass*. The varieties of the *staple* are the *Patriarch Astrakhan*, and *Astrakhan firsts*, *seconds*, and *thirds*. The *leaf* varieties are *firsts*, *seconds*, and *thirds*.[3]

3. A. Ruthenus, Linn. The *Sterlet*.—Inhabits the Black and Caspian Seas and their tributary rivers; and the Arctic Ocean. Its roe yields *caviare*. *Leaf* and *book* (*first* and *second*) *isinglass* are obtained from the swimming bladder.

4. A Stellatus, Pallas. The *Sewruga*.—Inhabits the Caspian and Black Seas and their tributary rivers. Yields *caviare* and *leaf isinglass*.

Professor Ludewig kindly sent me the dried air or swimming bladders of three species of *Acipenser*, namely, the *A. Huso*, *A. Güldenstadtii*, and *A. stellatus*. I had been for some time anxious to possess specimens of these swimming bladders, in order that I might further satisfy myself of the real nature and position of the isinglass membrane. In the second edition of my *Elements of Materia Medica*, pp. 1859 and 1861, I have stated that the innermost layer of the swimming bladder is insoluble in boiling water, and is not the gelatigenous or isinglass membrane. I came to this conclusion from a careful examination of the sound of the cod-fish, and of the unopened pipe and purse isinglasses of commerce, all of which I found to be lined with an insoluble epithelium. In the leaf isinglass imported from Russia, this membrane has been removed, probably by rubbing with a cloth; and as in some species of *Acipenser* this layer is exceedingly fine, its presence is apt to be overlooked. But in the swimming bladders of some other fishes it is much thicker, and its non-removal in them considerably deteriorates the commercial value of the isinglass which they yield. The insolubility of the inner lining of the Hudson Bay purse isinglass is well known to the dealers.

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[1] *History of British Fishes*, ii. 360.

[2] *Med. Zool.* ii. 1 and 349.

[3] T. W. C. Martius, *Lehrb. d. pharm. Zool.* S. 76, 1838.

Dr. Edward Martiny, the learned author of the *Naturgeschichte der für die Heilkunde wichtigen Thiere*, published at Darmstadt, has, however, denied the accuracy of my account of the gelatigenous or isinglass membrane. He describes these bladders as consisting of two membranes (*Hauten*) an *outer*, strong, shining and fibrous membrane, and an *inner* soft mucous coat. The outer membrane is covered by a peritoneal coat. "The inner membrane, namely the mucous membrane, is the so-called isinglass." To this sentence he has appended a foot-note, of which the following is a translation. "Pereira (*Elements of Materia Medica*, vol. ii., 2d edit. p. 1861) erroneously regards the middle coat as yielding gelatine."

This statement, emanating from so high an authority as Dr. Martiny, induced me to re-examine the subject, and the result is the confirmation of the accuracy of my former statement. I have now examined the swimming bladders of four species of sturgeon, and in all find their inner coat, or lining, to consist of an epithelium insoluble in water. In some, however, it is so exceedingly delicate as to require very careful microscopic examination to detect it. On one occasion I obtained the swimming bladder of the common sturgeon (*Acipenser Sturio*) caught in the Thames, and found its lining membrane to be a very delicate, but insoluble, epithelium. I gave a portion of it to my friend Mr. John Quekett, of the Royal College of Surgeons, and requested him to examine it, and the following is the reply which he sent me:—

"I have carefully examined the sections of air-bladder, and I find that commencing with the inner coat you have—

"1st.—An epithelial layer; then,
"2dly.—The membrane to which the epithelium is attached (basement membrane); then,
"3dly.—Some flaky spindle-shaped bodies, which give the silvery appearance; then,
"4thly.—Some fibrous tissue, arranged principally in two directions, probably the muscular or elastic coat; then,
"5thly.—Some areolar tissue; and,
"6thly.—Lastly of all, the serous coat.

"I have not tried the solubility of these layers in boiling water, but should think it must be the middle or thick substance which is the gelatinous coat."

On the receipt of the air-bladders of the three species of *Acipenser*, sent me by Professor Ludewig, I resolved to submit them to a careful microscopic examination in order to ascertain in them the existence or absence of an inner epithelial or insoluble layer. I have detected it in all of them.

a. Acipenser Huso.—This fish, called by the Russians the *Bieluga*, yields the isinglass known by the name of the *Bieluga* (or *Beluga*) *leaf*. The dried air-bladder is a pyriform bag about the size of a small pig's bladder. Its length is about eleven inches, its greatest diameter about five inches. The opening of the ductus pneumaticus is near the larger extremity.

b. Acipenser Güldenstadtii.—From this fish is obtained both *staple* and *leaf* isinglass. The dried pyriform swimming bladder, now laid before the Society, is of the kind called in commerce the pipe. Its length is about ten inches, and its greatest diameter about three inches. The opening of the ductus pneumaticus is at the larger extremity.

c. Acipenser stellatus.—This yields *leaf* isinglass. The pyriform swimming bladder of this fish, which I have received from Professor Ludewig, is also of the pipe kind. Its length is eight inches, and its greatest diameter two and-a-half inches.

But in Russia the acipenser is not the only genus from which isinglass is obtained, for it is also procured from *Silurus Glanis*,[1] which Dr. Royle[2] suggests may be the source of the *Samovey*[3] isinglass of commerce.

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[1] Pallas, *Reise durch verschiedene Provinzen des russischen Reichs*, Th. i. S. 139, Petersb. 1771.

[2] *On the Production of Isinglass along the Coasts of India, with a Notice of its Fisheries*, p. 29, Lond. 1842.

[3] This word is sometimes written *Samovey* or *Simovy*. I have been unable to trace its derivation. Dr. Royle's suggestion appears to me probable, since the Russian name for the Siluris Glanis is *Som*, while Albertus Magnus calls it *Sumus*. The Poles term it *Szum*.—

Brandt[1] thus describes the preparation of Russian isinglass. The swimming bladder is cut open, washed, and then exposed to the air with the inner silvery membrane turned upwards. The latter is then stripped off and placed in damp cloths, or left in the outer covering, and prepared or kneaded. It is then taken out of the cloths, and either merely dried (*leaf isinglass*) and twisted or folded in a serpentine manner, between three pegs, into the shape of a horse-shoe, heart, or lyre (*long* and *short staple*), or folded in the manner bookbinders fold printed sheets of paper (*book isinglass*). Jackson[2] has given figures to illustrate the manner in which the staple and book isinglass are made to retain their shapes by skewers.

Several kinds of *leaf isinglass* are imported from Russia. The finest kind is that from Astrakhan, of which one kind is said to be obtained from the Beluga (*Acipenser Huso*). These are imported from St. Petersburgh. The *Samovey leaf* is an inferior kind brought from Taganrod. *Sisane leaf* is the produce of a small fish; each leaf measuring only about 2½ inches each way, and weighing about a drachm: it looks like pieces of dried bladder, marked by two fibrous or muscular bands. *Kroski isinglass* I have not seen; but I am told it is in small circular membranous disks. *Long staple isinglass* is of fine quality. It is the produce of the Oural. [It is usually imported loose — at times strung on ropes. The latter kind is preferred.] Of *short staple* three kinds are known: the finest is from the Oural, and is distinguished by the name of Patriarch, but it is very scarce. The *Astrakhan short staple* is one of the best kinds. The *Samovey short staple* is of inferior quality. Two kinds of *book isinglass* are met with. That from the Oural is of excellent quality. *Samovey book* is an inferior kind. *Siberian purse isinglass* is of moderately good quality, and is in general demand. [A small kind on strings, in a necklace form, is sometimes imported.]

2. Brazilian Isinglass.[3]—This is imported from Para and Maranham; but it has not hitherto been ascertained from what fishes it is procured: though it is obvious, from a superficial examination of the commercial specimens, that they must have been obtained from at least several species or genera. Mr. Yarrell[4] suggests the genera Pimelodus and Silurus as the source of it. It comes over in the form of *pipe*, *lump*, and *honey-*

(Brandt and Ratzeburg, *op. supra cit.* ii. 31). Moreover, Martius says that staple, leaf, and book isinglass are produced from this fish. Now these are the three forms of the Samovey isinglass. [A note addressed to the author confirms this view. The isinglass in question comes from the Russian fish *Som.* The Russians having no article, make an adjective of Som by adding "*ovy.*" They pronounce it *Samovy*, although they spell it *Somovy.* There is another kind called *Leshovy*, from the fish *Lesh* or *Leshtohik* (Bream). It is more soluble than the Samovy kind, but scarcely of equal strength.—Ed.]

[1] Though the account above given by Brandt agrees with the statements of Pallas, Gmelin, Georgi, and Tooke, there must be some inaccuracy in it. I have before stated that the innermost membrane of the swimming bladder is insoluble;—but according to Brandt's statement, the innermost is the gelatinous membrane. The account which T. W. C. Martius (*Lehrbuch d. pharmaceut. Zoologie*, p. 71, Stuttg. 1838) gives of the preparation of isinglass in Russia confirms my views. The swimming bladders, he observes, are first placed in hot water, carefully deprived of adhering blood, cut open longitudinally, and exposed to the air, with the inner delicate silvery membrane upwards. When dried, *this fine membrane is removed* by beating and rubbing, and the swimming bladder is then made into different forms.

[2] Royle, *op. supra cit.* p. 21.

[3] Sometimes called *Cayenne Isinglass* (Guibourt).

[4] *Philosophical Transactions*, vol. lxiii. 1783.

comb. *Pipe Brazilian isinglass* must have been procured from a large fish. It is prepared by drying the swimming bladder unopened. In some cases this bladder is imported distended with air. The dried bladders, or *pipes*, as they are called, are from ten to twelve inches in length, and two or two and a half inches broad.

Their weight is about five ounces. Their shape is somewhat conical tapering at one extremity, and broader at the other, where, on either side, is a conical cæcal prolongation. It is devoid of smell. *Lump Brazilian isinglass* consists of two swimming bladders placed side by side, considerably separated at one end, and communicating at the other extremity with each other. When perfect, each lump somewhat resembles in shape a torpedo. Its size varies. A perfect though not very large specimen, measured eight inches in length, and, at the broadest part, five inches in breadth. Its weight is six ounces and a half. It consists of three portions, separated by constrictions. The largest portion is five inches broad, and three inches and a half long; flattish in front, rounded posteriorly. It consists of two sacs, placed one on either side. The middle portion is oblong, three inches long, and two inches broad: it consists of two sacs, which communicate with those of the preceding portion. The third portion is oblong, one inch and a half long, and three-quarters of an inch wide. It consists of one sac only, into which both the sacs of the middle portion open. *Honeycomb Brazilian isinglass* appears to be the largest portion of the lump kind split open. The lump variety is sometimes softened, and rolled out into thin ribbons, in this country. On account of its deeper colour and inferior solubility, Brazilian isinglass is not in demand for domestic use; though, as it is sold in the cut state, it is probably largely intermixed by shopkeepers with the finer kinds of Russian isinglass, and sold as such. As it is moderately cheap and soluble, it is in extensive use for fining by brewers, who are the principal consumers of this kind of isinglass. [When digested with boiling water, it leaves a very large proportion of undissolved white residue of a starchy consistency.]

3. New York Isinglass.—Occasionally *ribbon* isinglass is imported from New York. It is in thin ribbons of several feet long, and from an inch and a half to two inches in width. It is but little used in this country. It is less soluble than the Russian, and affords a dark-coloured solution.[1] Dr. J. V. C. Smith,[2] author of a work on the fishes of Massachusetts, states that it is obtained from the air-bladder of the common Hake (*Gadus merluccius*), which is thrown into water to macerate for a little while, and is then taken out and pressed between two iron rollers, "by which it is elongated to the extent of half a yard and more. It is then carefully dried, packed, and sent to market. The common cod (*Morrhua vulgaris*) yields a poorer kind of isinglass; but the hake only is known to the extensive manufacturers as fit for their purposes."

4. Hudson's Bay Isinglass.—I have been unable to ascertain from what fish this isinglass is procured.[1] It comes over in the *purse* form. A specimen in my possession measured twelve inches in length, and three inches and a half in diameter; its weight is one ounce and a half. It is of a light yellow colour, translucent, and free from taste and smell. The inner lining of the sac, which may be readily stripped off, is insoluble in water: the remaining membrane dissolves in boiling water.

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[1] *United States Dispensatory*; also *Journal of the Philadelphia College of Pharmacy*, vol. iii. pp. 17 and 92.

[2] In a letter to Dr. S. W. Williams, of Deerfield, Massachusetts, from whom I received the above information.

5. East India Isinglass.—It appears that, for a long period, this has been exported from Calcutta to China, but it has only recently occupied the attention of Europeans. It is probably the produce of a species of *Polynemus.*[2] But the fishes called, by Dr. Buchanan, *Bola,* and several species of Silurus, especially *Silurus raita,* also yield isinglass (Royle). Most of the specimens of Indian isinglass, which I have examined have an unpleasant fishy odour, which renders them totally unfit for domestic use, and greatly deteriorates their commercial value. A specimen of *East Indian purse isinglass* which I examined, consisted of an unopened swimming bladder flattened and dried. Its shape is oval-oblong; its length nine inches; its breadth three inches and a half; its weight seven ounces and a half. It has a strong, fishy smell, and a dark colour. Another kind (*East Indian leaf isinglass*) is merely the sac laid open and dried. It is eight or nine inches long, six or seven inches broad, and about three-tenths of an inch thick. A third kind (*East India rolled leaf isinglass*), which I have received from Dr. Royle, appears to have been formed by rolling out the preceding kind into thin plates. One specimen was about eighteen inches long, three inches and a half wide, and one-tenth of an inch thick. Some of the sheets are covered with a thin film of chalk.

Picked East India isinglass, kindly furnished me by Dr. Royle, is in small shreds, two or three inches long, and tapering at the extremities. It is hand-picked in India by the natives. The composition of this isinglass has been ascertained by Mr. Solly, and will hereafter be stated.[3]

Manilla isinglass.—A variety under this name has been recently imported. It is called *thin cake.* It is white and clean. It is equal in quality to Brazilian or Samovey book. The fish which yields it is found in the river of Manilla, and on the coasts of the Phillipines, Luconia. Chief mart, Manilla. Price four shillings per pound. It is smaller than the Brazilian; but it greatly resembles the lump Brazilian, and the fish is probably an allied species.[4]

6. Cod Sounds.—Cod sounds, in the dried state, are brought from Scotland, and used as a substitute for foreign isinglass. They are, however, usually preserved soft by salting, and dressed for the table.

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[1] Richardson, in his *Fauna Boreali-Americana,* part iii., says, that the sturgeons of North America are equally numerous with those of Asia, but that their sounds and roes are utterly wasted.

[2] Mr. M'Clelland (*Journal of the Asiatic Society of Bengal,* viii. 203) states, that Indian isinglass is yielded by *Polynemus Sele* of Buchanan. But, inasmuch as he obtained only sixty-six grains of isinglass from one of these fishes, while some of the specimens of commerce weigh from half to three quarters of a pound, it seems tolerably clear that the Indian isinglass of English commerce cannot be obtained from *P. Sele,* but must be procured from some larger fish. It may be the produce of *Polynemus teria,* Buchanan, or the new species of *Polynemus,* referred to by Dr. Cantor (*Journal of the Royal Asiatic Society,* v. 166, London) as the *Salliah* or *Saccolih.*

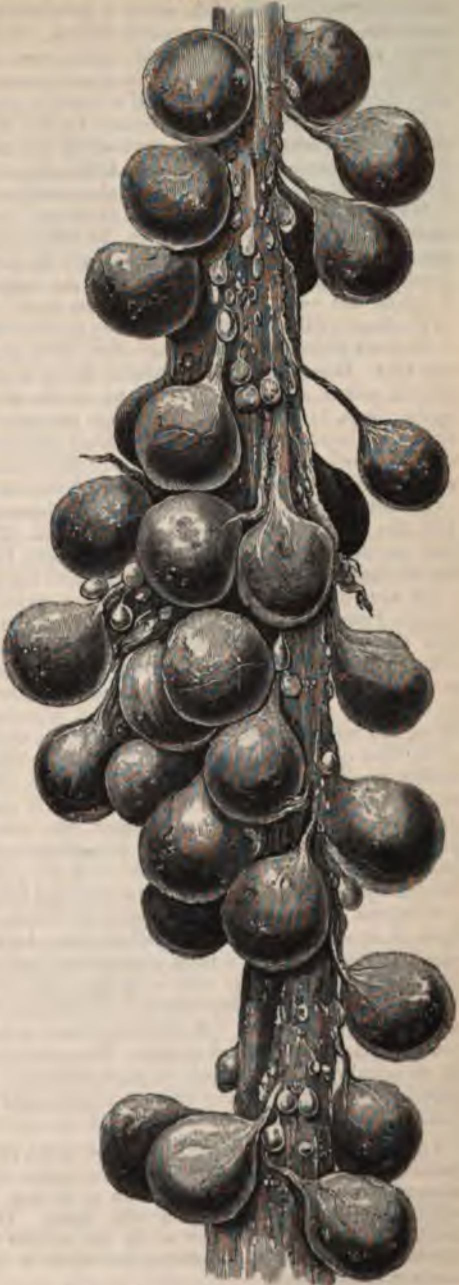
[3] For further details respecting East Indian isinglass, see Dr. Royle's work, *On the Production of Isinglass along the Coasts of India, with a Notice of its Fisheries,* London, 1842.

[4] Metcalfe, December 1842.

PURITY.—When isinglass is reduced to small shreds (*picked* or *cut isinglass*) it is scarcely possible to distinguish, by the eye, some of the inferior from the finer kinds. The best criteria are its whiteness, freedom from unpleasant fishy odour (when warmed by the breath), its almost entire solubility in water, and translucency of the jelly obtained on cooling from its hot solution. [No sample even of the best isinglass (Beluga or Astrachan leaf) is, however, completely soluble in boiling water. There is always some undissolved residue (albuminous membrane); but this is small in proportion to the goodness of the quality. In Beluga it may form one per cent.; in some kinds of Brazilian, as much as twenty per cent. The reader will find some good remarks by Mr. Redwood on the adulteration of isinglass in the Pharmaceutical Journal for May 1850, p. 503.—ED.]

SUBSTITUTION. — Hartshorn shavings and sole skins (when clean, sweet, and well prepared) are sometimes substituted for isinglass in fining. For domestic uses, *patent gelatine* is frequently employed as a substitute for isinglass.

FIG. 123.



False Isinglass from Para (natural size).

7. Para Isinglass.—A substance has been imported under the name of Isinglass, which, on examination, proves not to be isinglass, but the dried ovary of a large fish.

Two boxes which were imported did not contain more than 14 or 16 lbs. This so-called Isinglass consists of bunches of ova of the size and shape represented in figure 123. They somewhat resemble a bunch of grapes; and consist of ovoid or rounded masses, attached by peduncles to a central axis. By immersion in water this axis is found to consist of a convoluted membrane, to one side only of which these ovoid masses are attached.

A very superficial examination of this substance proves that it is neither the swimming bladder of a fish, nor is it gelatinous; but it is in reality the ovary of some large fish, and is of an albuminous nature. When soaked in water, its fishy odour becomes very obvious. The ovoid masses are *ova*. They are highly vascular on the surface, and are filled with an animal substance of a yellow colour. In general appearance they resemble the vitellus of a shark or ray.[1]

[From information communicated by Mr. Stitchbury to Mr. Redwood, it appears that the false isinglass here described by the author is derived from the ovaries of the *Silurus Parkerii*, commonly called *Gilbricker*. The fish is about three feet long, and weighs twenty pounds. It is very abundant in the rivers of Guiana.[2]—Ed.]

Gelatine. — Gelatine may be extracted from bones, by boiling them in water under pressure; or, more readily, by employing bones which have been previously digested in hydrochloric acid to extract the phosphate of lime. In this way a nutritious soup is prepared in Paris for the hospitals, and other pauper habitations.[3] Gelatine has even been extracted from fossil bones. A soup was prepared from one of the bones of the Great Mastodon, by the Prefet of one of the departments of France.

Nelson's Patent Gelatine is obtained from glue-pieces, freed from hair, wool, flesh, and fat.[4] It is probable that inferior kinds of isinglass are also employed. Two kinds of this patent gelatine are made up: — the best (called *gelatine of the first quality*) is opake; it is, by preference, made from the cuttings of the hides of beasts, or from the skins of calves: the inferior kind (called *gelatine of the second quality*) is transparent, and of a yellowish colour; it is made from non-transparent glue pieces. Both kinds are sold, cut somewhat in imitation of picked or hand-cut isinglass.

French gelatine is sold in thin sheets or layers, marked, like those of common glue, with the nets on which they have been dried. They are either uncoloured, or coloured red, green, or blue. [Some of this patent French gelatine is made at Paris from the cuttings of skins used for making white kid gloves.—Ed.]

[A very pure form of gelatine is now extensively sold under the name of *Swinburne's Patent Refined Isinglass*. It is procured from the skins of calves cut into very thin slices, and treated simply with water at or about 200°. No chemical substance whatever is used in its preparation. The skins are treated with successive quantities of water until all the gelatine is extracted. The common sorts of isinglass are treated in the same way, and a very pure kind of colourless gelatine is thus obtained from them, the insoluble residues being subsequently boiled up to make glue. The gelatine of the first quality thus procured is white, inodorous, and tasteless, entirely free from acidity or alkalinity. If previously soaked in cold water, it is entirely dissolved without leaving any residue on the addition of a small quantity of boiling water, and the solution on cooling, if not overheated, sets into a firm transparent jelly. The properties are the same whether it be procured from calves' skins, or from isinglass. The process simply deprives the isinglass and skins of their insoluble albuminous portions. Isinglass jelly thus refined still retains a slight fishy odour.

The test of the goodness of gelatine is this: — When boiling hot water is poured upon it, it should not form a yellow gluey-looking mass of an offensive odour, but it should be colourless, of a thick consistency, and entirely free from smell. The French gelatine is generally run into very thin sheets in order to conceal the yellow colour. It has no smell when dry, but is very offensive when treated with warm water in the manner above described. A pink or red colour is sometimes given to it in order to conceal its yellow hue and bad quality. The principle, gelatine, is liable to be deteriorated by chemical compounds used for its extraction. Gelatine thus prepared by chemical processes has found its way into the market, and has tended to give an evil reputation to this substance as an article of food and as an economical substitute for isinglass. But it is a well-known fact that isinglass owes its chief properties to *gelatine* alone, and chemistry and the microscope show that when this principle has been once extracted either from skins or fish bladder, its properties are identical, provided they have not been changed by any chemical process in the extraction. Swinburne's gelatine of first quality is not to be distinguished from the gelatine separated from the air-bladder of the sturgeon. The latter, weight for weight, yields a much larger proportion than the skin of the calf, and the process of extraction is more easy, but the principles are the same: they have the same properties and are adapted to the same uses.

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[1] [It was during his visit to the Museum of the College of Surgeons for the purpose of examining the preparation to which this description refers, that the late Dr. Pereira met with the serious accident which confined him to his bed, and from which he was just recovering, when he was suddenly seized with fatal illness. The above was written while he was confined to his bed, and it was one of the last articles from his pen. It therefore possesses an interest beyond that of the subject to which it relates. See *Pharmaceutical Journal* for January 1853.—Ed.]

[2] *Pharmaceutical Journal*, vol. xiii. p. 270.

[3] See D'Arcet, *Recherches sur les Substances Nutritives que renferment les Os*, Paris, 1829; also Edwards, *Recherches Statist. sur l'Emploi de la Gélatine*, Paris, 1835; and *Quarterly Journal of Science*, April, 1827.

[4] See the specification of his patent in *The Mechanic and Chemist* for 1840.

The term Isinglass is probably an English corruption of the German *Haasenblase*—bladder of the Sturgeon. To apply the term isinglass to gelatine extracted from skin is, therefore, not only a misnomer, but a mistake. All kinds of isinglass may be regarded as gelatine plus certain membranous impurities or adventitious substances. Gelatine, however, is not isinglass, but the true animal principle separated from these impurities.

It has been and still is a *vexata quæstio* among scientific men, whether gelatine is to be regarded in the light of a *product* or *educt* of the animal tissues. It appears to be an educt of the swimming bladder of the sturgeon, and is properly described by the author (infra) as a *constituent* forming from 86 to 93 per cent. of isinglass. If an educt of the air-bladder of the sturgeon, it must be equally an educt of the skin of young animals, as of the calf, *i.e.* it exists in the skin as such, and is not produced from it by the action of boiling water any more than starch is produced from grain by a similar process. The tissue of the skin is closer than that of the air-bladder; hence it requires a longer continuance of the action of water to separate the gelatine from the other principles. Acetic acid will, however, dissolve gelatine from the skin in the cold, and tannic acid (in tanning skins) combines with the gelatinous tissue in the cold to form leather. These facts show correctly and truly that gelatine exists in the skin as an independent principle like albumen.—ED.]

COMPOSITION.—Isinglass of fine quality was analysed by John,[1] who found the constituents to be *gelatine* 70·0, *osmazome* 16·0, *membrane* insoluble in boiling water 2·5, *free acid* (lactic ?) with *salts of potash* and *soda*, and some *phosphate of lime*, 4·0, and *water*, 7·0. These results, however, can scarcely be accurate; for dried flesh, as Berzelius[2] observes, does not contain more than 8 per cent. of osmazome; and if isinglass contained 16 per cent. it could not be kept dry when exposed to the air. Mr. E. Solly, jun.[3] examined three specimens of Bengal isinglass, and found the constituents to be *gelatine*, *albumen*, a small portion of *saline* and *earthy substances*, *osmazome*, and a minute trace of *odorous oil*. The quantities of gelatine in three specimens were respectively 86·5, 90·9, and 92·8 per cent.; while those of albumen were 13·5, 9·1, and 7·2 per cent.

EFFECTS AND USES.—The *dietetical* properties of gelatine have been already noticed. Considered *medicinally* it is an emollient and demulcent. It is employed, dissolved in water or milk, and rendered palatable by acid and sugar, as a nutritious substance for invalids and convalescents.

A solution of isinglass, with tincture of benzoin, is brushed over black sarcenet to form *Court* or *Black Sticking Plaster*. *Liston's isinglass plaster* consists of oiled silk coated with isinglass.[4] The preparation of *Gelatine Capsules* has been already described.

Isinglass is also employed as a clarifying or fining agent (for coffee, wines, and beer). Some of the constituents of these liquors unite with the gelatine, and form insoluble compounds, which precipitate, and in the act of precipitation the gelatine incloses within its meshes the matters which rendered the liquid turbid. The great consumers of isinglass are the brewers,[1] who employ principally the coarse Brazilian variety.

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[1] Gmelin, *Handb. der Chemie*, ii. 1468.
[2] *Traité de Chim.* vii. 668.
[3] Royle, *On the Production of Isinglass*, p. 40, Lond. 1842.
[4] *Pharmaceutical Transactions*, i. 145.

The following table of the different kinds of isinglass known in the London market was furnished to me by Mr. James Metcalfe, wholesale dealer in isinglass, of No. 20, Artillery Place, Finsbury Square.

Country.	Place of Produce.	Place of Export.	Name and Character.	Prices per lb. English.		Remarks.
				s. d.	*s. d.*	
Russia	The Oral (Ural)	St. Petersburgh ...	Long Staple Ural, 1st and 2d......	14 6	13 6	
	The Irtysch and Obi..............	”	Short ditto, Patriarch	- -	None.	Very choice an dear.
	Oural and tributaries	”	Ditto, ditto, 1st and 2d book ...	14 6	13 0	
	Astrakhan......	”	Thin leaf, 1st and 2d	14 6 to	9 6	These are th sorts which yiel the cut.
	The Volga and tributaries.....	”	Beluga, 1st and 2d	14 6	10 0	
			Cut by machine or hand	16 0 to 14 6	13 6 to 9 6	
			Pickings (the brown ends) ...	8 0		Refuse of the abov
	Tributaries of Black Sea......	Odessa ...	Sisane leaf	2 6	- -	Seldom imported.
	Tcherkaskoy...	Taganrog .	Kroski or Krosky	6 0	- -	Seldom inquired fo
	The Don and tributaries......	”	Samovey Leaf, 1st and 2d	3 9	3 3	Used for finings.
	Ditto	”	Ditto, Book 1st and 2d	4 0	3 6	In great demand.
		”	Ditto, Short Staple	5 0	- -	Seldom imported.
Siberia	The Irtysch and Obi......	St. Petersburgh....	Siberian Purse...	8 6	7 6	In good esteem.
North America	Hudson's Bay and rivers...	Hudson's Bay	Purse	5 6	6 0	A thin insoluble membrane lining the inside.
	United States	New York	Ribbon............	No price.	- -	Not in use.
South America	The Brazils	Maranham and Para	Pipe Brazil ...	5/0 to 4/	3 0	In general demand.
			Lump ditto ...	5/0 to 4/	3 0	
			Honeycomb do.	3 6	2 0	Not in much repute
			Cut Brazil......	7/6 to 6/6	6 0	Used perhaps for mixing.
East Indies	Bay of Bengal	Calcutta...	Purse .... Leaf	2 0	4 0	Objected to on account of its fishy smell and imperfect solubility. When carefully prepared, it may equal the Brazilian kind.
			Picked	3 0	4 0	
Scotland	Coasts of Scotland.........	....	Cods' Sounds ...	1 9 to	1 6	if dry and sweet.
England	England.........	....	Sole Skins	0 10		if clean, sweet, and well prepared.

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[1] Full particulars respecting the mode of fining beer are given by Jackson, in his *Essay on British Isinglass*, Lond. 1765.

379. MORRHUÆ OLEUM.—COD-LIVER OIL.

(Gadus Morrhua, *L.*—Morrhua vulgaris, *D.*)

HISTORY.—The oil obtained from the livers of the Common Cod, and various other allied species of fish, appears to have been for a long period a popular remedy in various countries of Europe for rheumatism, and some other diseases, although its use by medical practitioners is comparatively recent. In 1782 cod-liver oil was strongly recommended in chronic rheumatism by Dr. T. Percival,[1] and in 1807 by Dr. Bardsley,[2] who states that it was in high repute in Lancashire. [In Hufeland's Journal from 1822 to 1826, Dr. Schenks published a series of papers urging its claims as a remedy in many chronic disorders. This led to its general adoption in Germany, and ultimately in other states of Europe as well as in the United States of America.[3] It was not, however, until the publication of Dr. John Hughes Bennett's "Treatise on the Oleum Jecoris Aselli," in 1841, that the attention of British medical practitioners was particularly directed to the value of this oil as a medicine. In 1849, Dr. C. J. B. Williams called attention to the therapeutic use of cod-liver oil in pulmonary consumption. In Belgium, Holland, and some parts of Germany, this oil has long been in use as a medicinal agent, but in France it has not been extensively employed until within the last few years.[4]—ED.]

ZOOLOGY.—This oil is principally procured from the common cod (*Morrhua vulgaris; Gadus Morrhua*) formerly called *Asellus major;*[5] also from allied species, as the Dorse (*Gadus Callarias*), the Coal-fish (*Gadus carbonarius*), the Burbot (*Lota vulgaris*), the Ling (*Lota molva*), and the Torsk (*Brosmius vulgaris*).[6]

[The oil recognised by the Pharmacopœias is that obtained from the common cod[7]—*gadus morrhua*, and the ling—*gadus molva*, or *lota molva.* It is received from Newfoundland. England was formerly supplied with oil from Bergen, in Norway, obtained from the livers of the *gadus callarias*, the dorse or dorche; and the *gadus carbonarius*, or coal-fish. From this source Germany and the North of Europe still receive their supply. Cod-liver oil is prepared on a small scale in the Shetland Islands and on the English coasts, chiefly from the *gadus morrhua*, *gadus molva*, and *lota vulgaris*, the burbot.

Dr. De Jongh enumerates several varieties more or less interesting in a medical point of view; *e. g.* the *Gadus virens*, *g. tau*, *g. minutus*, *Asellus mollis minor* and *major*, *g. æglefinus*, *g. brosme*, *g. lota*, *Mustela fluviatilis.* The most important of these are the:—

1. *Gadus Morrhua*, or *Asellus major*, the common cod, called in Norway the *Kabeljau*, *Torsk*, or *Thorsk*, abundant on the coasts of Norway, France, and England, but especially on the coasts of Newfoundland.

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[1] *London Medical Journal*, iii. 393.

[2] *Medical Reports*, p. 18.

[3] Transactions of *American Medical Association*, vol. ii. p. 113.

[4] [A very full history of the introduction of cod-liver oil in different countries is given in the first chapter of Dr. De Jongh's Treatise, *L'Huile de Foie-de-Morue, envisagée sous tous les rapports comme moyen thérapeutique*, p. 262, Paris, 1853.—ED.]

[5] See Schonevelde, *Ichthyologia*, p. 18, Hamb. 1624. Pliny (*Hist. Nat.* lib. ix cap. 28, ed. Valp.) mentions two kinds of *Asellus:* namely, a smaller kind called *callariæ*, and a kind termed *bacchi*, caught in deep water only.

[6] See Dr. J. H. Bennett's *Treatise on the Oleum Jecoris Aselli*, p. 17. Lond. 1841.

[7] The *gadus* belongs to the order *Thoracici*, and family *Malacopterygii*, inhabiting principally the Mediterranean and Baltic seas.

2. *G. callarias*, *Asellus striata*, the *Dorse*, found principally on the Norwegi
coasts, and around the Lofoden Islands.

3. *G. molva*, *A. longus*, denominated in England the Ling, or Länga in Norw
Found abundantly on English coasts, less so than the two preceding on the coasts
Norway.

4. *G. carbonarius*, *A. minor*; the *Ley* in Norway, the *Coal-fish* in England.
with in great abundance on the coasts of Norway, England, and Scotland.

5. *G. pollachius*, *A. haitingo-pollachius*, the Haakjerius or Haifish of Norway, fou
on the coasts of Norway. The liver of this fish yields a large quantity of oil, havi
an unpleasant odour.

6. *G. merlangus*, *A. albus*, the common *whiting*.—Ed.]

Some of the fish-oils[1] of commerce are obtained exclusively from t
liver, others are procured from the adipose tissue diffused through t
body of the animal generally. In the former, therefore, we are prepar
to find bile-constituents which are not obtainable from the latter.
fishes, properly so called, the distribution of oil in the body of the anim
is not uniform. In the *Gadidiæ* or Cod-tribe (common cod, dorse, co
fish, pollack, turbot, ling, torsk, &c.), in the *Squalidæ* or Sharks, and
some other fishes, almost the whole adipose tissue of the animal is co
centrated in the form of oil contained in the liver.[2] On the other han
in the salmon, herring, sprat, and wolf-fish, the oil is more diffus
through the body of the animal, and the liver is, comparatively speakin
devoid of it. The oils obtained from the livers of the different speci
composing the tribe *Gadidiæ*, appear to be very similar in their physic
and chemical qualities, and there is good reason for believing that the
agree in their medicinal properties. To all of them the term *oleu*
jecoris aselli,[3] *oleum jecoris gadi*, or *cod-liver oil*,[4] is indiscriminately applie
though it is commonly used, especially in this country, to indicate th
oil procured from the liver of the common cod (*Gadus morrhua*, Cuv.
It would be better, therefore, to employ the term *oleum jecoris morrhua*
or simply *oleum morrhuæ*, when it is intended exclusively to designate th
latter oil.

Preparation.—In different countries there are different modes o
preparing the oil. The cod oil met with in the London market is th
produce of Newfoundland, where, according to Pennent,[5] it was thus pro
cured: — "They take a half tub, and, boring a hole through the bottom

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[1] I use the term *fish-oils* in its popular and commercial acceptation, and include under i
not only the oils obtained from fishes properly so called, but also those procured from othe
aquatic animals, as the *cetacea* and seals.

[2] Professor Owen, in his *Lectures on the Comparative Anatomy and Physiology of the Verte*
brate Animals (Part 1, *Fishes*, p. 242, 1846), observes, "that the myriads of dog-fish capture
and commonly rejected on our coasts, show that the fishermen have not yet taken ful
advantage of this anatomical fact, which exposes to them an abundant source of a pure an
valuable oil."

[3] Pliny (*Hist. Nat.* lib. iv. cap. 28) states that there were two kinds of fishes called *aseli*
one smaller, termed *callariæ*, the other found in deep water, and denominated *bacchi*: th
latter were preferred to the former. Varro (*Opera Omnia*, p. 21, Durdrechti, 1619) says tha
these fishes derived their name *aselli* from their resemblance in colour to the ass. By some
later writers the term *asellus* has been extended to several species of the cod tribe:—tha
the common cod is called *asellus major*; the ling *asellus longus*; the coal-fish, *asellus niger*
the whiting, *asellus albus*; the dorse, *asellus striatus*; the pollack, *asellus haifingo*, &c. A few
years ago, a writer in one of the medical journals, mistaking the meaning of the word *asellus*
gravely announced that "*oil of the liver of the ass*" had been introduced as a remedial agent
into Germany from Sweden.

[4] The term *cod-liver oil* is here used to indicate the oil obtained from the livers of any of the
cod-tribe. In this sense it is about equivalent to the Latin term *oleum jecoris aselli*.

[5] *Arctic Zoology*, iii. 305, 1792.

press hard down into it a layer of spruce boughs; upon which they place the livers, and expose the whole apparatus to as sunny a place as possible. As the livers corrupt the oil runs from them, and, straining itself through the spruce boughs, is caught in a vessel set under the hole in the tub's bottom." "At Newhaven, near Edinburgh, according to Dr. J. H. Bennett, the fishermen simply boil the livers in an iron pot, and then filter it [the oil] through a towel containing a little sand."

[Dr. De Jongh, in order to reconcile the discrepancies in the various accounts of the modes of preparation of cod-liver oil, applied to the chief manufacturers for information. The most general mode of preparation in Norway, is to store the livers in vats or tubs, as soon as they are separated from the fish; they are there left until the end of the fishing season, when the oil that has separated is decanted, and forms the pale oil of commerce. The residue of the livers then being treated by heat yield the darker oils.

Dr. Garrod[1] disputes the statement by De Jongh to the effect that the oil prepared in England is obtained by heating the livers in water. "The best English oil," Dr. Garrod states, "is thus prepared:—The livers are collected daily, so that no trace of decomposition may have occurred, carefully examined, in order to remove all traces of blood and impurity, and to separate any inferior livers; they are then sliced, and exposed to a temperature not exceeding 180° Fahr. until all the oil has drained from them. This is filtered, afterwards exposed to a temperature of about 50° Fahr. in order to congeal the bulk of the margarine, and again filtered and put into bottles well secured from the action of the air.[2] An oil thus prepared is less tender, or remains fluid at a lower temperature than any other." Messrs. Taylor, of Vere Street, were among the earliest manufacturers of cod-liver oil, in London, and have bestowed great attention and cost upon the perfection of its preparation. They use only what are technically termed "live" livers, that is, the livers of perfectly fresh fish. Their experience enables them to detect, by their external appearance, the livers that have been removed from fish that have died before their arrival in port. Every liver is opened, examined, washed free from blood, and if sound and fit for use is cut in pieces, and put with others into a large pan with a portion of water. To the external surface of the pan, steam is admitted, and the temperature being very carefully adjusted to about 180° Fahr., the livers are heated for a time sufficient to allow of the complete separation of the oil. The result of this process is the production of a sweet and nearly colourless oil, which is skimmed off and filtered through flannel. This having been congealed for the separation of its margarine, is again filtered when required for use. The purest and least flavoured variety of oil is by these means obtained.—ED.]

[DESCRIPTION.—The English market has of late years been supplied with cod-liver oil from Newfoundland of a *pale liver colour*, to which the preference is now generally given over the brown, which is chiefly imported into Hamburgh from Greenland.—ED.]

Three principal varieties of oil are, however, now met with in England. These are:—

[[1] *Brit. and For. Med. Chir. Rev.* Jan. 1856, p. 5.

[2] Messrs. Bell and Co. effect this separation of the solid fat.]

1. Pale, or nearly colourless:—Newfoundland and English.
2. Yellow or light brown:—Bergen, or Norwegian.
3. Dark brown or black:—Newfoundland and Norwegian.

These varieties owe their characters partly to their several modes preparation, and partly to the state of the livers used for the extracti of the oil. The lightest coloured oil is that which is separated from t livers quickly or before putrefaction has commenced. The darker o have either remained longer in contact with the livers, have been pr pared by higher temperatures, or have been obtained from livers in whi decomposition had taken place.

Continental writers also distinguish three varieties of cod-liver oi one white or pale yellow, a second brownish-yellow, a third dark-brow But between the finest pale yellow or almost colourless oil, and the dar brown cod-oil used by curriers, there is an almost infinite variety shade, so that no absolute difference can be founded on colour onl De Jongh made, in Mulder's laboratory, a very elaborate analysis three kinds of cod-liver oil:—1, pale oil; 2, pale brown or brown o and 3, dark brown or black oil. He assigns to these varieties t following properties:

1. *Pale cod-liver oil.*—Golden yellow; odour not disagreeable; n bitter, but leaving in the throat a somewhat acrid fishy taste; rea feebly as an acid; sp. gr. 0·923 at 63·°5 Fahr. Cold alcohol dissolv from 2·5 to 2·7 per cent. of the oil; hot alcohol from 3·5 to 4·5 per cent in ether it is soluble in all proportions.

2. *Pale brown cod-liver oil.* (Brown oil.)—Colour that of Malaga win odour more disagreeable than that of pale oil—De Jongh describes as not disagreeable—bitterish, leaving a slightly acrid fishy taste the throat; reacts feebly as an acid; sp. gr. 0·924 at 63·°5 Fah Cold alcohol dissolves from 2·8 to 3·2 per cent. of it; hot alcohol fro 6·5 to 6·8 per cent. Ether dissolves it in all proportions.

3. *Dark brown cod-liver oil.* (Black oil.)—Dark brown, by transmitte light, or black greenish, in thin layers transparent; odour disagreeabl empyreumatic; taste bitter and empyreumatic, leaving behind in th fauces an acrid sensation; reacts feebly as an acid; sp. gr. 0·929 at 63· Fahr. Cold alcohol dissolves from 5·9 to 6·5 per cent. of it; hot alcoh from 6·5 to 6·9 per cent. of it. In ether it is soluble in all proportions.

COMPOSITION.—Cod oil has been analysed by several chemists. Th following is the analysis of Marder.[1] In 200 grains of the oil he foun the following substances:—

In the Pale Oil.		*In the Black Oil.*	
Green soft resin	0·104	(brown resin	0·130
Brown hard resin	0·026	(black resin)	0·156
Gelatine	0·312		0·936
Oleic acid	111·833		95·000
Margaric acid	20·625		8·000
Glycerine	16·832		18·000
Colouring matter	11·500		25·000
Chloride of Calcium	0·1046		0·2092
Chloride of Sodium	0·1179		0·1883
Sulphate of Potash	0·0361		0·0614
	161·4906		147·6809

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[1] *Pharm. Central Blatt für* 1837, p. 536.

Since the above analyses were made, *iodine* and *bromine* have been detected in this oil.[1]

De Jongh found the principal constituents of these oils to be *oleate* and *margarate of glycerine*, possessing the usual properties. But they also contained *butyric* and *acetic acids*, *the principal constituents of the bile* (bilifellinic acid, bilifulvin, and cholic acid), *some peculiar principles* (among which the substance called *gaduin*), and not quite one per cent. of *salts*, containing iodine, chlorine, and traces of bromine. Moreover, he found that the oil always contained free *phosphorus*.

The following table shows (according to De Jongh's very minute analysis) the proportions of the constituents in the three kinds of oil:—

	No. 1.	No. 2.	No. 3.
Constituents.	*Pale Oil.*[2]	*Brown Oil.*	*Black Oil.*
Oleic acid (with *Gaduin* and two other substances)	74·03300	71·75700	69·78500
Margaric acid	11·75700	15·42100	16·14500
Glycerine	10·17700	9·07300	9·71100
Butyric acid	0·07436	—	0·15875
Acetic acid	0·04571	—	0·12506
Fellinic and cholic acids, with a small quantity of margarine, olein, and bilifulvin	0·04300	0·06200	0·29900
Bilifulvin, bilifellinic acid, and two peculiar substances	0·26800	0·44500	0·87600
A peculiar substance, soluble in alcohol	0·00600	0·01300	0·03800
A peculiar substance, insoluble in water, alcohol, and ether	0·00100	0·00200	0·00500
Iodine	0·03740	0·04060	0·02950
Chlorine, and traces of bromine	0·14880	0·15880	0·08400
Phosphoric acid	0·09135	0·07890	0·05365
Sulphuric acid	0·07100	0·08595	0·01010
Phosphorus	0·02125	0·01136	0·00754
Lime	0·15150	0·16780	0·08170
Magnesia	0·00880	0·01230	0·00380
Soda	0·05540	0·06810	0·01790
Iron	—	—	a trace.
Loss	3·00943	2·60319	2·56900
Cod-Liver Oil	100·00000	100·00000	100·00000

By reference to this table there will be observed some slight differences in the composition of the three kinds of oil. Whether these are constant or accidental, further investigations are required to determine. From De Jongh's analysis, it would appear that the *pale* oil (No. 1.) is richest in oleic acid and glycerine—that the black oil (No. 3.) contains the largest amount of margaric, butyric, and acetic acids, and of the substances peculiar to cod-liver oil—and lastly, that the *pale brown* oil (No. 2.) is richest in iodine and saline matters. [In the pale brown oil (No. 2.) it will be remarked that the butyric and acetic acids are not set down as constituents. It is stated that this was owing to an accident—that these acids, in fact, are in excess both in the pale brown and dark brown (black) oil (No. 3.). If this be so, we are at a loss to comprehend how the 100 parts, by weight, can be made up in their absence. The "loss" does not satisfactorily explain the matter, for this is certainly greater in the pale, than in the two coloured varieties. Another remarkable feature of these analyses is, that while the acetic, phosphoric, and butyric acids are set down to the one hundred thousandth part of a grain, the weight represented by "loss" is more than equivalent to the combined weights of fourteen out of seventeen different ingredients, including the biliary principles!—ED.]

I now proceed to notice in detail some of the substances which enter into the composition of this oil.

1. *Of Gaduin.*—For the discovery of this substance in cod-liver oil we are indebted to De Jongh. It may be obtained as follows:—Saponify cod-liver oil by means of caustic soda, and decompose the soap thus obtained by means of acetate of lead.

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[1] [We must refer the reader for copious details on the analysis of this oil to the treatise of Dr. De Jongh, already quoted, p. 25.—ED.]

[2] [This analysis, made in 1843, refers to Bergen or Norwegian oil of a pale yellow colour. —ED.]

The resulting lead-soap is treated with ether, which takes up oleate of lead a gaduin, and leaves undissolved, the margarate of lead. The ethereal solution is da brown. If it be decomposed by sulphuric acid, brown oleic acid is set free. T brown colour of this acid is owing to the presence of gaduin. To separate the latt add excess of caustic soda to the oleic acid, by which oleate of soda is formed. Thi insoluble in the excess of soda. It is then dissolved in alcohol, and the alcoh solution cooled below 32° Fahr., by which the oleate of soda is separated, leavi for the most part the gaduin in solution. By the addition of sulphuric acid gaduin is precipitated from its solution. Gaduin is a brown substance which is solu in alcohol, but is rendered insoluble by evaporating its solution to dryness. T alcoholic solution yields, on the addition of neutral acetate of lead, a copious preci tate, composed of $C^{35}H^{22}O,Pb,O$. If this lead salt be digested with carbonate of so it is decomposed, and a soda salt is obtained in solution, from which sulphuric a precipitates a brown acid. This when dried at 288° Fahr., was found to have the f lowing composition: $C^{35}H^{23}O^{9}$. Gaduin is odourless, tasteless, and of a dark bro colour. It is completely insoluble in water, but is for the most part soluble in b ether and alcohol. Its insoluble portion augments every time the solution is eva rated. When dry it is brittle and pulverisable. It is insoluble in both nitric a hydrochloric acids. In sulphuric acid it dissolves, and acquires a blood red colo but from this solution it is precipitated both by water and alkalies. It is soluble alkalies. Diffused through water and treated with chlorine it becomes decolouris In burning, it yields an odour first of acetic acid, and afterwards of cod-oil, and lea behind a small quantity of ash.

The *insoluble modification of gaduin*, to which allusion has already been made blackish-brown, pulverisable, insoluble in water, alcohol, ether, and diluted sulphu acid, but by concentrated sulphuric and hydrochloric acids it is converted into a bla powder, without freely dissolving: in hot nitric acid it gradually and completely d solves. It dissolves in alkalies, forming a red-coloured solution. In burning, evolves the odour of acetic acid, and leaves about 0·822 per cent. of ashes. Wh dried at 238° Fahr., its composition is $C^{39}H^{26}O^{12}=C^{35}H^{22}O^{8}+C^{4}H^{3}O^{3}+HO$: that gaduin ($C^{35}H^{22}O^{8},HO$) combined with acetic acid ($C^{4}H^{3}H^{3}$). But De Jongh's form scarcely agrees with this experimental result. He says that analysis gave him 7 per cent. of hydrogen, whereas his formula indicates about 7·3 per cent. Berzeli states that when he read De Jongh's account of gaduin, he was struck with the analo of the reactions of this substance with those of bilifulvic acid; and he tells us that was disposed to think that gaduin is primitive bilifulvic acid, and that the reddis brown substance, insoluble both in alcohol and water, which he (Berzelius) separat from bilifulvin by long and numerous operations, is only the insoluble modification gaduin. This point, however, at present remains undetermined. *Gaduin* is containe in all the three varieties of oil examined by De Jongh. At first it is yellow, b under the influence of atmospheric air it acquires a brown colour.

2. *Fatty acids; margaric and oleic acids.*—These acids, as obtained from cod-liv oil, do not appear to differ in their nature and composition from the same acids pr cured from other sources. De Jongh analysed them in the form of margarate an oleate of lead. The results were as follows:—

Margarate of lead	$C^{34}H^{33}O^{3},PbO$.
Oleate of lead	$C^{44}H^{39}O^{4},PbO$.

3. *Glycerine.*—This was obtained by saponifying cod-liver oil by caustic soda. Th residual lye was decanted from the soda soap, saturated with sulphuric acid, and th sulphate of soda prepared by crystallisation. The residual glycerine was compare with glycerine procured from olive-oil and lead, and found to be darker coloure All these kinds of glycerine were decolourised by adding basic acetate of lead to th glycerine solution, though they again became coloured when submitted to evaporatio [According to Winckler, cod-liver oil, by saponification with potash, is separated int oleic and margaric acids, and oxide of propyle. With oxide of lead, propylic acid i formed. It yields no glycerine on saponification, the glycerine ($C^{6}H^{3}$) being repre sented in cod-liver oil by propyle ($C^{6}H^{6}$).[1] Whether saponified by potash or oxide o lead, no hydrated oxide of glyceryle (glycerine?) is obtained. The production o *propylamine* ($NH^{2}C^{6}H^{7}$), on the addition of ammonia, takes place only in cod-live

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[1] *Pharmaceutical Journal*, vol. xii. p. 450.

oil, and in no other officinal fatty oil. It would seem, therefore, that, chemically speaking, its place in the Materia Medica cannot be supplied by any other oil.[1]—ED.]

4. *Bile constituents.*—When cod-liver oil is shaken with water, an emulsion is obtained from which the oil slowly separates. The aqueous liquid becomes clear by filtration. That which had been obtained by shaking the dark brown (or black) oil with water was coloured and empyreumatic; but the other kinds of oil did not colour the water. The liquid invariably had a slightly acid reaction, and the oil which had been shaken with it was clearer, had a feebler odour, and reacted less powerfully as an acid. By boiling the oils with water, the same results were obtained. By evaporation, the aqueous fluids from all the three kinds of oil yielded a reddish-brown extract, which, softened by heat, was slightly soluble in water, was more soluble in ether, and completely so in alcohol. Alkaline solutions dissolved it, and acids threw it down again in the form of a reddish-brown flocculent precipitate. The extracts had a peculiar odour and a bitterish taste. The quantities obtained from the different kinds of oil were as follows:—

	With cold water.	*With hot water.*
Pale oil	0·607 per cent.	0·513 per cent.
Brown oil	0·890 „	0·849 „
Black oil	1·288 „	1·256 „

When successively treated with ether, alcohol, and dilute spirit, all these extracts yielded the same results.

By ether, a reddish-brown, transparent, glutinous extract was obtained, which melted by heat, stained paper, and had the odour and taste of bile. After some time, small crystals made their appearance in it. It was slightly soluble in water, but readily so in ether as well as in alcohol. A solution of carbonate of ammonia being added to its ethereal solution caused the separation of the mixture into two layers; an upper turbid layer, which by evaporation yielded some drops of *olein*, some crystals of *margarin*, and a *brownish mass* which was identical with that procured by the evaporation of the lower layer. This brown mass had a bitter taste, was separated by water into a soluble and insoluble portion, and consisted of *fellinate* and *cholate of ammonia*. The extract which had been exhausted by ether, yielded to alcohol a blackish-brown, odourless, bitter, shining, hygroscopic mass, which dissolved with difficulty in water, and consisted of *biliverdin*, *bilifulvin*, and *bilifellinic acid*. Dilute spirit removed from the residual extract a black shining substance, soluble in alkalies, concentrated sulphuric acid, and hot acetic acid, but insoluble in nitric and hydrochloric acids. From its alcoholic solution, baryta-water and acetate of lead precipitated it of a brown colour. It left no residue by burning.

The residue of the aqueous extract, left after the action of the three above-mentioned solvents, contained an *organic substance* (whose nature has not been determined) and *inorganic salts*, in which chlorine, phosphoric and sulphuric acids, lime, magnesia, and soda were found, but no potash or iodine.

5. *Iodine, bromine, and chlorine.*—Considerable, though as I conceive unnecessary, importance has been given to the fact that cod-liver oil frequently or usually contains both iodine and bromine. To the presence of one or both of these substances has been ascribed the whole or part of the remedial efficacy of the oil. A little consideration, however, would be sufficient to prove that their therapeutical agency in the oil must, if any, be exceedingly small. The proportions in which they exist in the oil is inconstant, though in all cases very small. Moreover, beneficial effects have been produced by the use of the oil, which neither iodine nor bromine is capable of producing.

Some chemists have failed to detect *iodine* in cod-liver oil. De Jongh says, that it is present in every genuine oil, but that the only certain mode of detecting it is to saponify the oil, and carbonise the resulting soap. He confirms Stein's remark, that neither by immediately carbonising the oil, nor by saponifying it, and then decomposing the soap by acids, can the iodine be detected. It follows, therefore, that iodine exists in the oil neither in the free state nor in that of metallic iodide, but probably in organic combination—perhaps as an iodic fatty acid. De Jongh determined the proportion of iodine by forming iodide of palladium; every 100 parts of anhydrous iodide of palladium were considered equivalent to 70·34 parts of free iodine.

[[1] *Pharmaceutical Journal*, vol. xii. p. 37. See also, for some remarks on the comparative value of the analysis of De Jongh and Winckler in a therapeutical view, the same Journal, vol. xiv. p. 413.]

The largest amount of iodine found in genuine oil is less than 0·5 per cent. If th amount obtained be larger than this, fraud may be suspected. It is said by Dr. Martin that some dishonest druggists have introduced iodine into the oil for the purpose augmenting its commercial value. Nay, it is stated that an artificial cod-liver oil h been made by combining iodine with common fish or train oils.

De Jongh detected *bromine* in the oil by Balard's process. The carbonised soap w digested with alcohol, and the alcoholic extract treated with chlorine gas and eth Its proportion was estimated in conjunction with that of chlorine, as the quantity w too small to admit of accurate separation. The *chlorine* was determined by preci tating it as chloride of silver from the watery extract of the carbonised soap.

6. *Phosphoric and sulphuric acids.* — *Phosphorus.* — De Jongh determined presence and quantity of these ingredients in the following way: The oil was saponi by potash, and the soap thus obtained decomposed by hydrochloric acid, by which fatty acids were separated. From the solution the phosphoric acid was precipita by a nitrate of iron (whose proportions of oxide was known) and ammonia, and sulphuric acid by means of nitrate of baryta. In order to determine the presence quantity of free phosphorus or sulphur, a given quantity of oil was decomposed concentrated nitric acid, and the quantity of phosphoric and sulphuric acids in oxidised liquid ascertained by the above-mentioned method. More phosphoric was procured from the oxidised than from the unoxidised liquid, and the proportio phosphorus was calculated from the excess of acid.

7. *Acetic and butyric acids.*—De Jongh separated these volatile acids from cod-li oil by adding sulphuric acid to the soda-soap, and distilling the liquid thus obtain The distilled product had a peculiar odour. It was saturated with barytic water, evaporated to dryness. One portion of the residue was insoluble in alcohol, the ot was soluble. The insoluble salt was acetate of baryta with two equivalents of w $(=C^4H^5O^5,BaO)$; the soluble salt was butyrate of baryta. The soluble salt obtai from the pale oil gave the formula $2(C^8H^6O^3),BaO,6HO$; that procured from the p brown sort gave the formula $C^8H^6O^3,BaO,HO$.

Rancid cod-liver oil emits an odour like common fish, or train-oil, and we mi therefore, expect that phocenic acid would be a constituent of it. De Jongh did detect it; but thinks that phocenic acid may perhaps be resolvable into acetic butyric acids—a supposition somewhat improbable, seeing that phocenic acid conta considerably more carbon than either butyric or acetic acid. Berzelius observes, the presence of acetic acid in cod-liver oil, in a form which is not extractable water, is remarkable, because it leads to the supposition that it is contained in form of a peculiar fat, which would be the acetate of lipule. It will be unnecess to enter into any details with respect to the other constituents of the oil.

[PURITY.—Of the three varieties of oil, to which reference has be made, it is obvious, as the author suggests, that the most colourless, pr pared entirely from fresh livers, must possess the constituents of the in their purest state. This kind of oil is most readily tolerated by t human stomach. The darker varieties, which are obtained either at higher temperature, or from livers in a state of putrefaction, contain large proportion of volatile acids and biliary matters, which render the unfit for therapeutic purposes. "In the brown kind, margaric acid, t constituents of the bile, butyric and oleic acids, and peculiar substanc predominate; while the lighter sort is precisely the poorest in the bodies, but is richest in oleic acid and glycerine, and is somewhat poor in inorganic salts, than the light brown kind, in which they are, as were, concentrated. This is what we should expect from the mode preparing the various kinds."[2]

Experience fully confirms the inference drawn from observation of th chemical constitution of these varieties of cod-liver oil as to their relativ

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[1] *Naturgeschichte der für die Hielkunde wichtigen Thiere*, Darmstadt, 1847.

[2] De Jongh, *Chemical Gazette*, vol. i. 1842–43, p. 710.

therapeutic value. At the Brompton Hospital it has been found that the use of the darker kinds cannot be long continued; the clear and straw-coloured inodorous oil is that which is now administered in this institution. Dr. Williams, in the latest edition of his Principles of Medicine (1856), affirms the superiority of the pure fresh oil. Dr. De Jongh advocates the employment of the darker varieties on the ground of their richness in volatile acids (butyric and acetic) and biliary matters, and regards the objection to these as a mere prejudice, arguing that if ammonia, which is obtained from the decomposition of animal substances, be admissible as a therapeutical agent, so also should the volatile acids contained in the brown cod-liver oils. It will not be difficult to refute this argument by an appeal to De Jongh's analysis. It will be perceived that the pale brown oil which he now recommends contains no butyric or acetic acid.[1] The fact is, however, cod-liver oil, not cod-liver oil plus volatile acids, is the remedy that is found useful in practice.

In support of his opinion Dr. De Jongh cites authorities and shows a statistical comparison of the effects of dark and pale oil on eighteen cases of scrofulous and rheumatic disease. The advantage appears greatly on the side of the dark oil to the extent of two months' earlier cure, *i. e.* a period of three compared with a period of five months. It must, however, be admitted that the data adduced are too limited to justify the inference that the darker has so much greater therapeutic power than the pale oil; besides, the statement is, we believe, adverse to the larger experience of English practitioners. There may, however, be some ground for the opinion that different kinds of oil may be more serviceable in different diseases. Dr. De Jongh quotes from M. Osius to the effect that the dark oil has a more decided action on the abdominal organs, while the pale oil exerts greater influence upon inflammatory affections of the respiratory organs. Dr. Garrod[2] states that the result of his experience and inquiries, is to establish the equal value of pale cod-liver oil, as a therapeutical agent in phthisis, scrofula, and rheumatism. The only possible question being whether the matters resulting from putrefaction contained in the dark varieties have ever produced any additional good effect in chronic rheumatism by reason of their stimulant action. Of this there is at present no proof. Dr. Garrod sums up his argument in favour of the pale oil, thus:—

"1st. It is the real oil, as contained in the liver of the cod fish—rich in biliary matters, and also in iodine and other inorganic principles.

"2nd. It contains no products of putrefaction, such as are found in the dark oils.

"3rd. It sits more easily on delicate stomachs.

"4th. Experience has proved it to be a most effective therapeutic agent."—ED.]

ADULTERATIONS.—The characters by which we judge of the genuineness, purity, and goodness of the oil, are partly physical, partly chemical. The physical characters which are usually employed are principally colour, odour, and flavour. The finest oil is that which is most devoid of

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[[1] Ante, p. 783. See also *Pharmaceutical Journal*, xiv. p. 413.
[2] *Loc. cit.*]

colour, odour, and flavour. The oil as contained in the cells of the fresh liver is nearly colourless, and the brownish colour possessed by the ordinary cod-liver oil used by curriers is due to colouring matters derived from the decomposing hepatic tissues and fluids, or from the action of air on the oil. Chemical analysis lends no support to the opinion, at one time entertained, that the brown oil was superior, as a therapeutical agent, to the pale oil. Chemistry has not discovered any substances in the brown oil which would confer on it superior activity as a medicine. On the other hand the disgusting odour and flavour, and nauseating qualities of the brown oil, preclude its repeated use.[1] Moreover, there is reason to suspect that, if patients could conquer their aversion to it, its free use, like that of other rancid and empyreumatic fats, would disturb the digestive functions, and be attended with injurious effects.

Of the chemical characters which have been used to determine the genuineness of cod-liver oil, some have reference to the iodine, others to the gaduin or to the bile constituents. I have already stated that some fraudulent persons are said to have admixed iodine (either free iodine or iodide of potassium) with train oil to imitate cod-liver oil. The presence of this substance may be readily detected by adding a solution of starch and a few drops of sulphuric acid, by which the blue iodide of starch is produced; or the suspected oil may be shaken with alcohol, which abstracts the iodine.

But though we may thus readily prove that the suspected oil contains no artificially added iodine, the iodine which is naturally contained in, and more intimately combined with, the oil, may be frequently recognised by another process. Marchand[2] gives the following directions for detecting it: Saponify the oil with soda, carbonise the soap thus obtained, digest the coal in distilled water, add a drop of starch paste, and subject the mixture to the action of a voltaic battery, the positive pole being placed in contact with the starch paste, the negative pole with the solution. If iodine be present, the starch becomes blue. Marchand states that by this test, iodine can be detected in the urine of a patient soon after he has taken the oil. This, however, is certainly not always correct, for I submitted the urine of a young gentleman, who, for several weeks had taken with great benefit a table-spoonful of cod-liver oil thrice daily, to the action of a galvanic battery of fifty pairs of plates for several hours, without obtaining the slightest evidence of the presence of iodine.

Sulphuric acid has been employed as a test for cod-liver oil. If a drop of concentrated sulphuric acid be added to fresh cod-liver oil, the latter assumes a fine violet colour, which soon passes into yellowish or brownish-red. Some samples of oil produce at once the red colour, without the preliminary violet tint. Gobley,[3] who noticed this reaction in the case of oil of the liver of the ray, says, that oil which has been prepared by ebullition in water does not possess this property, but yields with sulphuric acid a clear red colour. This, however, is an error, at least with respect to cod-liver oil. It has been erroneously supposed by some persons that this violet colour was due to the evolution of iodine by the action of the acid on an alkaline iodide contained in the oil. If that were the case, the presence of a little starch-paste would be sufficient to convert the violet into an intense blue colour; which is not the case. The colouration in fact depends on the action of sulphuric acid on some one or more organic constituents of the oil, and the following facts lead me to infer that it is in part due to the presence in the oil of one of the constituents of the bile.

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[1] [See, on the qualities and impurities of this oil, De Jongh's Treatise, p. 145. The brown oil here referred to is probably the dark brown or black oil of De Jongh and not the yellow or light brown variety.—ED.]

[2] *Lehrbuch der Physiologisch. Chemie.*

[3] *Journal de Pharmacie*, 3me sér. v. 308, 1844. [The effect is well brought out by placing a few drops of the oil on a piece of white porcelain, and then adding a few drops of concentrated sulphuric acid.—ED.]

It is well known that, in 1844, Pettenkofer[1] pointed out a new test for bile. If to a liquid supposed to contain bile about two-thirds of its volume of oil of vitriol be added, the liquid kept cool, a few drops of a solution of cane-sugar (four or five parts to one of sugar) be added, and the mixture shaken up, a violet red colour is produced, provided bile be present. This test succeeds very well, if we dissolve a little extract of ox-bile in water, and test the solution with the sugar and oil of vitriol. The colour developed agrees with that produced by the addition of oil of vitriol to cod-liver oil, which according to De Jongh, contains the essential constituents of the bile. Pettenkofer remarks that the presence of a very great excess of chlorides will change the violet-red colour into a brownish-red. This fact is deserving of notice, because it may aid in accounting for the fact that some specimens of cod-liver oil strike a brownish-red, not a violet-red colour, with oil of vitriol. Strecker[2] confirms Platner's observation that both cholic and paracholic acids produce the same colour with sugar and oil of vitriol, as bile; so that Pettenkofer's test doubtless acts on one or both of these acids. De Jongh has shown that cholic acid is contained in cod-liver oil, and we have, therefore, good reason for believing that it is in part by the action of oil of vitriol on this acid that the violet-red colour is produced in cod-liver oil. But for the development of this colour in bile it is necessary to use, besides oil of vitriol, a third agent (sugar). Pettenkofer observes that for cane-sugar we may substitute grape-sugar or starch; in fact, any substance which can by the action of oil of vitriol be converted into grape-sugar. No such substance has hitherto been detected in cod-liver oil, and, therefore it may be said the necessary ingredient to produce this characteristic reaction of oil of vitriol on cholic acid is wanting. Strecker has recently supplied the wanting link. In his valuable paper, to which I have already referred, he observes that acetic acid may be substituted for sugar. To the liquid supposed to contain bile add a few drops of acetic acid, and then concentrated sulphuric acid, when a magnificent purple-red colour is developed. If the quantity of bile be small, it may be necessary to use heat. Now, as cod-liver oil contains acetic acid, we have the requisite agent to enable the oil of vitriol to act on the cholic acid, and the development of the purple or violet-red colour is then readily accounted for. I have already noticed the red colour produced by oil of vitriol on gaduin (supposd by Berzelius to be derived from the bile) Here then is another source for the red colour caused by the action o sulphuric acid on cod-liver oil.

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[1] *Ann. der Chemie und Pharmacie*, B. lii. S. 90, 1844; also Simon's *Chemistry*, translated by Dr. Day, ii. 193.

[2] *Ann. der Chemie und Pharmacie*, Bd. lxv. 15, 1848.

It follows, therefore, from what has now been stated, that oil of vitriol is a test for liver oils. It does not distinguish one liver oil from another for it reacts equally with the oil of the liver of the ray and with oi of the liver of the common cod. Neither does it distinguish good cod-liver oil from bad, for it produces its characteristic reaction both wit common brown cod-oil and with the finest and palest qualities. But i serves to distinguish oil procured from the liver, from oil obtained fro other parts of the animal.

[The experiments of Dr. De Jongh were at first supposed to pro that the substance which he called *Gaduin* was the active principle o cod-liver oil. This view we are informed is not confirmed by later an more complete observations. The presence of *gaduin* is a characteristi of cod-liver oil; it distinguishes it from other fish liver oils, while choli acid is common to the whole of this class of oils. In his latest work, D Jongh does not attribute special importance to the gaduin: he rathe trusts to the entire oil. The gaduin is stated to be removed or destroye in oils filtered through charcoal.—Ed.]

[Mr. Beasley communicated to the late Dr. Pereira the subjoined method by whic he detected iodine in cod-liver oil:—To detect iodine in the liquor which accompanies the oil from the liver of cod-fish, it is sufficient to put a portion of it into porcelain capsule with a little starch, and add a few drops of a fresh and rather dilut solution of chloride of lime. The characteristic colour manifests itself either immediately or after standing a short time.

The detection of the iodine in the oil was thus effected:—℥iss. of hydrate of potas was triturated in a Wedgwood mortar with about f℥vj. of warm water, and f℥ij. of th oil. The mortar was set in a warm place, and the mass triturated occasionally unti the combination appeared complete. The soapy compound was thrown, by portions into a crucible heated to redness in a common fire, and the heat continued till th soap was calcined. The residuum was triturated with f℥ij. or less of water, and th mixture thrown on a filter. A portion of the clear lixivium was placed on a capsul with a little starch and nitric acid, moderately diluted, gradually added. A considerable effervescence takes place, and as soon as the point of saturation is passed the mixture becomes coloured. A considerable excess of acid, however, destroys th colour.—Ed.]

Physiological Effects.—At the commencement of its use cod-liver oil frequently causes nausea, disagreeable eructation, and occasionally vomiting. In the dose of a tablespoonful, it acts as a laxative, diaphoretic, and diuretic.[1] But Taufflieb[2] declares that in doses of from two to four spoonfuls a day, he never found it "exert any appreciable influence upon the urine or perspiration, or produce any disturbance in the economy." The disagreeable flavour of the oil, especially of the dark-coloured varieties, sometimes creates nausea and sickness, but when habit has surmounted the repugnance to it, these effects cease. In several cases it has proved emmenagogue;[3] and on some occasions it has given rise to a cutaneous eruption.[4] Dr. Bardsley found that most persons were disposed to get fat under its use. [Increase of weight has been strikingly shown to be the result of the use of cod-liver oil, at the Brompton Hospital. This was observed in two hundred and nineteen cases, to the extent of 70 per cent., taking both stages of the disease and the sexes collectively; a loss of weight in 21 per cent.; while in 8½ per cent. the weight remained stationary.—ED.]

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[1] Schenk, *Hufeland's Journal*, Bd. xxii. 1822.

[2] *London Medical Gazette*, Feb. 28, 1840.

[3] Bennett, *op. supra cit.* pp. 46 and 47.

[4] Ibid. pp. 16 and 47.

[The researches of Dr. Theophilus Thompson, Dr. Garrod, Dr. Williams, and others, with various substitutes, tend to the conclusion that this oil owes its action to its oleine, and that the presence or absence of iodine, bromine, &c., in the infinitely small proportions in which they are met with as constituents of cod-liver oil, cannot affect the results of its administration.[1] Some chemists have failed to detect iodine in cod-liver oil. Other oils are not so readily digested as cod-liver oil, hence they are less suitable for medicinal use. The superior therapeutic powers of cod-liver oil may possibly be owing to some peculiar constitution of its oleine. It is, however, certain that no other oil is equally adapted to the purposes for which this is used. In the opinion of Dr. Williams, cod-liver oil is a nutrient, affording fat of a better kind, more fluid, less prone to change, and more capable of being absorbed into the structure of the body, than other forms of fat.

Dr. Williams supposes that cod-liver oil exerts its therapeutic influence on the second and third stages of consumption by checking the oxidation of the exudation corpuscle, to which, according to him, suppuration is to be referred. So highly combustible a body as this oil, Dr. Williams suggests, must check this process of oxidation, and so prevent the degeneration of the corpuscles into the aplastic condition of pus globules.—ED.]

[Dr. Theophilus Thompson[2] has found that during the administration of cod-liver oil to phthisical patients that their blood grew richer in red corpuscles, and he refers to a previous observation of Dr. Franz Simon to the same effect. The use of almond or olive oil did not produce this result, but cocoa-nut oil acted like cod-liver oil.—ED.]

USES.—Although it has been used more or less successfully in a considerable number of diseases, the cases in which it has proved most successful are those of a gouty, rheumatic, scrofulous, or phthisical nature. But even in these it requires a long-continued use to prove successful. One writer who has employed it observes that its use must be continued,—"at least a month, often six weeks, and sometimes for years." As the oil contains iodine, and as it proves most successful in those maladies in which this element proves successful, it has been suggested that iodine is its active principle. Taufflieb, among other authorities, denies this, and asserts that the properties of the two are not identical, for the one succeeds where the other fails.[3]

The oil is best adapted for relaxed, torpid, and phlegmatic temperaments, and for scrofulous subjects. In plethoric habits, and where irritation of the stomach and bowels, or inflammation, exists, its use is contraindicated.

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[1] Vide *infra*. p. 795.

[2] *Proceedings of the Royal Society*, April 27, 1854; and *Lectures on Pulmonary Consumption*, pp. 78—85.

[3] For an account of Ascherson's speculations on the *modus medendi* of this oil, see Dr. Bennett's *Treatise* before cited, p. 53. [See *post*, for some remarks on this subject. As iodine cannot be detected in all samples, it is clear that the medicinal efficacy of this oil cannot be ascribed exclusively to this agent.—ED.]

Rheumatism, scrofula, and *phthisis* are the diseases in which it has proved most successful. In *rheumatism* it is indicated in the chronic forms of this disease, where the muscles and tendons are rigid, and the joints nearly inflexible. In chronic *gout* it is said not to be so efficacious. [Dr. De Jongh cites numerous authorities in favour of the efficacy o cod-liver oil in *chronic* rheumatism, and chronic gout, in glandular swellings, scrofula in its various manifestations, mesenteric tabes, and pulmonary phthisis.—Ed.] In *scrofula* it has proved successful in most forms of the disease, but especially when it affected the bones (as in rickets, caries, &c.), and in tabes mesenterica. In the latter intractabl form, its efficacy has been surprising.

[*Phthisis.* — The experience of the profession at large appears to hav established the fact that cod-liver oil is one of the most efficacious o all remedies in arresting the progress of pulmonary phthisis: that i enables patients to struggle on longer against the inroads of the disease and thus sometimes to obtain cicatrization and contraction of cavitie which otherwise must have produced speedy death. The "Firs Medical Report" of the Hospital for Consumption, at Brompton, brough to the notice of the profession the results of the earliest trial, on a larg scale, of cod-liver oil in phthisis.[1] From the statistical results observe in five hundred and forty-two cases, published in that Report, we hav abridged the following table:—

	First Stage.		Second and Third Stages.		All Stages.	
	Per Cent.		Per Cent.		All Ages.	
	Males.	Females.	Males.	Females.	Both Sexes.	
					Total.	Per Cent.
Improved........	72·1	62·1	53·2	69·9	342	63·1
Arrested	17·8	28·1	14·3	13·6	98	18·1
Not improved...	10·0	9·7	32·3	25·4	102	18·8

The reporters add that when it is recollected that of the whole number treated at the Hospital without the oil, the disease was arrested in only 5 per cent., the value of this remedy, under the use of which the disease appears to have been arrested in 18 per cent. of the cases, must be considered very great, and the result proves that cod-liver oil exerts a greater controlling influence over phthisis than any other remedy.

Dr. C. J. B. Williams[2] confirms the favourable reports of the therapeutic action of cod-liver oil in phthisis. In the second stage of the disease, Dr. Williams states that he has seen a large number of cases very decidedly and lastingly improved; and even in the third stage, the progress of the disease has been arrested.—Ed.]

[[1] Dr. Theophilus Thompson states that upwards of six hundred gallons of cod-liver oil were consumed at the Brompton Hospital, up to the year 1854.

[2] *London Journal of Medicine,* vol i., 1849.]

Chronic skin diseases.—Attention was drawn to the use of cod-liver oil in the treatment of these diseases by Dr. Marshall Hall some years since.[1] In tinea favosa, impetigo, and chronic eczema, it has been found efficacious as a topical application. [Mr. Thomas Hunt[2] says that he has found cod-liver oil of very great value in acne, lupus, sycosis menti, and other chronic cutaneous affections.—Ed.] In *chronic ophthalmia*, especially of a scrofulous kind, it has been given internally, and, in some cases, applied to the eye with benefit. In *paralysis* also it has been found beneficial by Schuppmann[3].

ADMINISTRATION.—For an adult, the dose at the commencement is a tablespoonful, which has sometimes been increased to six times this quantity (!). This dose is to be repeated two, three, or four times a day for several weeks or even months. One patient consumed thirty-six lbs. of oil in two years and a half ! ! (Taufflieb). [It does not appear that very large doses of the oil are required : on the contrary, it is the opinion of some practitioners that doses of one or two teaspoonsful are equally efficacious with larger quantities, and are better tolerated by the stomach. The dose given at the Brompton Hospital is one drachm at the commencement. In some few cases it has been increased to one ounce and a half.

Dr. Theophilus Thompson is of opinion that the action of cod-liver oil is promoted by the addition of liquor potassæ.[4]—Ed.] Dr. Bardsley gave from ℥ss. to ℥iss. twice or thrice a day in warm table-beer. For children of twelvemonths or under, the dose is a teaspoonful night and morning. The addition of some aromatic oil (as of lemon, peppermint, cassia, or anise) partly covers the unpleasant taste and smell. It is sometimes taken in the form of an emulsion. Peppermint water and lozenges have been recommended for covering the unpleasant taste of the remedy. [A minute portion of common salt taken both before and after the dose of oil will sometimes enable the stomach to bear this remedy when all other devices fail. At the Brompton Hospital a small dose of hydrocyanic acid in mucilage is sometimes used to overcome irritability of the stomach produced by the oil. Orange wine has been very extensively employed as a vehicle for its administration, and is by some physicians regarded as a therapeutic adjunct,—while by others the use of any alcoholic vehicle is considered to augment the irritability of the stomach.

Dr. De Jongh considers the addition of any flavouring substance to cover the taste of the oil not only superfluous, but contrary to the object intended. He allows, however, that children may, after taking the oil, have comfits, and adults a morsel of biscuit or a little wine to cover the irritation of the fauces, which, in some cases, remains for a while.

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[1] *London Medical Gazette*, x. 796.

[[2] *Med. Times and Gaz.*, Sept. 15, 1855.]

[3] For further details respecting the therapeutic uses of this oil, the reader is referred to Richter's *Ausführl. Arzneim.* ; Dierbach's *Neuest. Entd. in d. Mat. Med.* p. 270, 1828 ; and *Ibid.* i. 352, 1837 ; also D. Bennett's *Treatise*, already quoted. [See also *L'Huile de Foie de Morue envisagée sous tous les rapports comme Moyen Thérapeutique*, par L. I. de Jongh, Paris, 1853 ; and an article on Cod-Liver Oil and its Substitutes, by Dr. Garrod, in the *Brit. and For. Med. Chir. Rev.*, No. xxxiii., Jan. 1856, p. 1.—Ed.]

[4] *Lectures on Pulmonary Consumption*, London, 1854, p. 72.

The fact has now been repeatedly noticed, that patients taking the oil, and more particularly children, after a time not only get accustomed to, but acquire a relish for, the flavour of the oil. The oil should be administered soon after a meal.

When pure cod-liver oil is given immediately after a farinaceou meal without any vehicle, it rarely creates nausea, eructation, or vomiting Much depends upon the quality of the oil.

If iodine has been added to imitate the brown variety, irritation of th mucous membrane and violent sickness may be produced, and in som cases biliary disturbance and scaly eruptions have followed. Wher however, the stomach resists the use of the oil, it may be administered i the form of enemata, taking care that the bowels be previously emptied Dr. De Jongh has applied the oil *externally* in scrofulous and rheumati affections; compresses of lint being soaked in it and applied over th seat of the disease. Dr. Theophilus Thompson[1] also speaks favourabl of frictions with cod-liver oil.—ED.]

[**OLEUM MORRHUÆ CUM QUINA.** In January, 1855, Mr. Bastick introduced to the notice of the profession a solution of quinine in cod-live oil as a new medicinal agent. The solution is effected by adding anhydrous quinine, in fine powder, to the oil contained in a suitable vesse and applying the heat of a water-bath until a clear solution is formed The oil acquires a darker colour as the quinine is dissolved. Th quantity of quinine may be varied according to the wish of the prescriber, but the proportions which have been proposed are two grains to th ounce. It is essential that the quinine should be anhydrous, in which state it may be obtained by precipitating the quinine with ammoni from a solution of the sulphate, washing and drying this precipitate and fusing it in a porcelain dish.[2]

Proposed Substitutes for Cod-Liver Oil.—Dr. Garrod[3] has given an account of various proposed substitutes for cod-liver oil. Oils from the livers of other species of the *Gadus* present no perceptible difference in their therapeutic or chemical constitution. Oils from the ray and shark closely resemble cod-liver oil. Sperm, seal, and southern whale oil have yielded favourable results, but are not tolerated by the stomach, and could not therefore be persevered in. Dr. Theophilus Thompson has from his experiments arrived at "the conviction that fish oils generally resemble one another in their remedial powers, although differing in their aptitude for digestive assimilation in the human stomach." M. Bretonneau considers whale and cod-liver oil to be equally efficacious in the treatment of disease. Neats-foot and other animal oils have been tried with favourable results where their repugnant flavour could be overcome. Dr. Garrod suggests the trial of *Lard-oil*, which is largely produced in the United States. This is stated to have been successfully used in Germany. Vegetable oils, in general, are unfit substitutes for cod-liver oil. Dr. Theophilus Thompson has, however, recently employed a new oleaginous substitute, the cocoa-nut oleine, obtained by pressure from cocoa-nut fat or oil, and subsequently purified. Dr. Garrod also speaks favourably of the effects of this oil, but has found that it could not be long continued on account of its producing nausea, and disturbance of the stomach. He adds: from the observed effects of these substitutes it would appear that cod-liver oil acts in a great measure simply as oleine.

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[1] *Lettsomian Lectures*, 1855, p. 35.

[2] *Pharmaceutical Journal*, vol. xiv. p. 427.

[3] *Brit. and For. Med. Chir. Rev.*, Jan. 1856; and *Lectures on Pulmonary Consumption*, by Dr. Th. Thompson, pp. 86—102.

Shark-liver oil.—This is obtained from the livers of sharks caught on the coast of Africa. It is remarkable for its very low specific gravity. Hitherto sperm oil, which has a specific gravity of 0·875, was the lightest oil known: but the sp. gr. of shark-liver oil is only 0·866. It gives with sulphuric acid the usual reaction of liver oils. According to Mr. Mercer, the sample which he examined was imported into Liverpool from Marseilles.—ED.]

Class IX. Aves. — Birds.

CHARACTERS.—Vertebrated animals, with red and warm *blood*, respiring by *lungs*, and the young of which are produced from *eggs*. Body covered with *feathers*, and general conformation organised for flying.

ORDER I. GALLINÆ, *Linnæus*.—GALLINACEOUS BIRDS.

CHARACTERS.—*Bill* short, convex, in some genera covered by a *cere*. Upper *mandible* bending from its base or only at the point; nostrils lateral, covered by a membrane naked, or feathered. *Tarsus* long. Three *toes* before, united at their base by a membrane; hind toe articulated on the tarsus above the junction of the anterior toes.

380. GALLUS BANCKIVA *var.* **DOMESTICUS,** *Temminck.*— **THE DOMESTIC COCK AND HEN.**

Phasianus Gallus, *Linn. E.*

(Ovi albumen; Ovi vitellus, *L.*—The egg, *E.*—Ovum, *D.*)

HISTORY.—No mention is made of this animal in the Old Testament. Both the male and female are referred to in the New Testament.[1] Aristotle[2] calls the cock *ἀλεκτρυὼν*,—the hen *ἀλεκτορίς*.

ZOOLOGY. **Gen. Char.**—*Bill* of medium size, strong, base naked. Upper *mandible* arched, convex, bent towards the point. *Head* surmounted by a crest or plume. *Ears* naked. Three *toes* before, united to the first joint; the hind toe raised from the ground. *Tarsus* with a long and bent *spur*. Middle *feathers* of the tail arched. *Wings* short.

Sp. Char.—*Comb* dentated. *Throat* wattled. *Feathers* of the neck linear and elongated. *Body* variegated with beautiful colours. *Tai* compressed and ascending. *Comb* and *wattles* of the female less than those of the male.

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[1] *Matthew*, xxvi. and xxiii.

[2] *Hist. de Animal.*

Some doubt exists as to the origin of our domestic cock and hen. Sonnerat[1] affirm that all the varieties originate from the *Jungle Fowl* (*Gallus Sonnerati*); while Temminck refers them to the *Javan Fowl* (*Gallus banckiva*).

Structure of the Ovarium and Development of the Egg.—The *Ovariu* (*racemus vitellorum*) or *egg-organ*, consists of a cluster of ova, in a hen beginning t lay, about 500 in number. The stalk by which each ovum is attached to the ovarium is called the *petiolus*. The size of the ova exceedingly various: when quite ripe, they are as large as the yelk of an egg; the smaller ones are white, the larger ones yello Each ovum, when ripe, is composed of a *calyx*, the *yelk-bag*, and the *yelk*. The *caly* constitutes the outer coat or covering of the ovum, and consists of two layers—a outer one, derived from the peritoneum, and an inner one, which is somewhat thicker Between these two coats the vessels ramify. The *petiolus* is merely a prolongation o the calyx: it is studded with a number of small ova resembling vesicles. On th part of the calyx of a ripe ovum which is opposite the petiolus is a whitish curve stripe, called the *stigma*, indicating the spot where the calyx bursts, to allow the escap of the yelk. The *yelk-bag*, or *membrana propria vitelli*, is within the calyx, and closel invests the yelk. It is a flocculent, delicate, fine coat. In the early stage of the ovum the yelk is constituted of a pellucid fluid lymph, and is hardly distinguishable from th *vesicula cicatriculæ*. It then becomes whitish, and subsequently yellow, globules o oil making their appearance. In a ripe ovum, it is viscid, tenacious, and of an orang yellow colour; and lies in the calyx, with its long axis towards the petiolus. It i composed of three layers, the middle one having the deepest colour; the innermos enclosing a white fluid called the *albumen centrale* (or *substantia alba vitelli*), fro which passes *a little canal* to that part of the surface of the yelk called the *cicatricula.*

The internal surface of the yelk-bag is lined with a very thin stratum of globules in form and figure like those of the blood, but arranged organically. The *cicatricul* or *tread* (as it is improperly called), is formed by an accumulation of these globule forming a mammiform heap, the convexity of which is towards the centre of the yelk and is usually situated nearer the petiolus than the stigma. In the top of this is th so-called pellucid *pore*, which is occupied by a small vesicle discovered by Purkinje[2] and called by him the *vesicula germinativa*, or *vesicula cicatriculæ*. It is found in al the ovarian ova, and seems to be a natural organ, since it is found in the ova of fowl which have never had access to the male. When the yelk falls into the infundibulum, this vesicle disappears. The Oviduct has some resemblance to a convoluted intestine. It is situated on the left side of the animal. Its superior expanded free extremity is called the *infundibulum*, the edges of which are fimbriated. Inferiorly, the oviduct opens into the cloaca. It is attached to the spine by the *mesometrium*. The *infundibulum*, or expanded portion of the tube, receives the ovum as it escapes from the calyx of the ovarium. The upper part of the ovum is lined by a fine villous membrane, covered with follicles secreting the albumen, or glaire, and thrown into a number of longitudinal folds. The first layer of albumen which the ovum receives forms the *membrana chalazifera* of Dutrochet; at either end of which is a soft, pellucid, albuminous nodule, which may be regarded as the *rudimentum chalazarum*. During the descent of the ovum in the oviduct, it receives fresh deposits of albumen; and, as it undergoes spiral rotations in its passage, the above-mentioned processes become curved spirally, and in the perfect egg constitute the *chalazæ*, *grandines*, *appendices albuminis*, or the *poles* or *treddles*. From one chalaza to the other are observed, in many eggs, one or more white striæ, formed by a thickening of the membrana chalazifera. Vicq-d'Azyr called this appearance the *zona albicans*.

The *albumen*, *glaire*, or *white* of the egg, is not uniform in its consistence. The thickest portion is that which is first deposited around the yelk. Proceeding from without inwards, the three layers of albumen are denominated *albumen primum*, *a. secundum*, and *a. tertium*. Just before the egg arrives at that part of the oviduct called the uterus, it receives its outer coat, the *pellicula ovi*. In the middle, or so-called uterine portion of the oviduct, is formed the *calcareous shell*. Some eggs are expelled without it; these are termed *oon eggs*. The chalk is first deposited in small polygonal pieces, having a crystalline appearance; but, when the deposit has attained a certain thickness, all traces of crystallisation are lost.

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[1] *Voyage aux Ind. Orient.* ii. 148.

[2] *Symb. ad ovi avium histor. ante incub.* Lipsiæ, 1830.

Hab.—Domesticated in all the four quarters of the globe.

Description.—Eggs (*ova*) are too well known to need much description. Their specific gravity varies from 1·080 to 1·090. By keeping they become lighter, as a result of the evaporation of a portion of water. Dr. Prout[1] found, that in two years an egg lost $544\frac{3}{10}$ grains. The relative weights of the different parts of the egg are, according to the same authority, as follows:—*shell and membrane*, 106·9; *albumen*, 604·2; *yelk*, 288·9; (total, 1000). By boiling in water an egg loses two or three per cent.

1. Egg-shell (*Testa Ovi; Putamen Ovi*).—This consists, according to Prout, of *carbonate of lime*, 97; *phosphate of lime and magnesia*, 1; *animal matter, with traces of sulphur and iron*, 2. The chalk renders the egg absorbent and antacid; hence its use to neutralise the acidity of wines.

2. Pellicula Ovi (*Membrana Putaminis*).—An albuminous membrane which lines the shell. It is soluble in alkalies, and from its solution is precipitated by acids. It weighs about 2·35 grains (the whole egg being supposed to be 1000 grains). At the larger end of the egg it forms the *follicula aëris;* the air of which, according to Bischoff, contains 23·475 per cent. of oxygen.

3. White or Glaire (*Albumen* seu *Album Ovi*) consists of two or three laminæ, which are not homogeneous, as two parts at least are discernible,—viz. a solid, probably organised albumen, having the appearance of a very fine delicate membrane, forming a series of cells, in which is contained the liquid albumen. Glaire or white of egg consists, according to Gmelin, of *albumen* 12·0, *mucus* 2·7, *salts* 0·3, and *water* 85·0. According to Dr. Bostock,[2] *white of egg* consists of *water*, 80·0, *albumen* 15·5, *uncoagulable matter* 4·5=100·0. The coagulability of albumen by heat, and its incoagulability by acetic acid, distinguish it from caseine. Albumen or glaire (or *ovalbumen*) is distinguished from albumen of the serum of the blood (*seralbumen*) by its being coagulated by ether (?). The membranous tissue in which the liquid albumen of eggs is contained is said by Couerbe to be devoid of nitrogen: he calls it *albumenin* or *oonin*.

4. Yelk (*Vitellus Ovi*) is a kind of yellow emulsion, consisting of oil suspended in water by means of albumen, and enclosed in a sac called the *yelk-bag*. On its upper surface is seen the cicatricula. At the extremities are the twisted flocculent *cholazæ*. The yelk consists, according to Dr. Prout, of *yellow oil, with crystallisable fat* 28·75, *albumen* containing *phosphorus* 17·47, and *water* 58·8. Dr. Prout[3] says the yelk of egg consists of *water* 170·2, *albumen* 55·8, *yellow oil* 91·0=316·5. The yellow oil (*oleum ovi*) may be obtained by boiling the yelk hard, and digesting in ether or alcohol, which dissolves the oil. By distilling off the alcohol from the filtered tincture, the oil is left behind.

Physiological Effects and Uses.—Both the glaire and the yelk are highly nutritive; the latter, on account of the oil which it contains, is somewhat less easy of digestion than the white. Both are more readily assimilated when in the soft state than when hardened by heat. Considered as medicinal agents, they are emollient and demulcent. The glaire is a valuable agent in the treatment of poisoning by bichloride of mercury, sulphate of copper, and the bichloride of tin. Its efficacy in these cases depends on the combination of the albumen with the oxide or chloride of the metal. [The yelk, as well as the white, exerts antidotal powers, and may therefore be freely used.—Ed.] The glaire is also used as a demulcent or sheathing agent in all cases of corrosive or acr poisoning. The yelk is a constituent of the *mistura spiritûs vini gallici.* is also used for preparing emulsions. Its oil has been applied to crack nipples. The white or glaire is employed as a clarifying agent for wi and some other liquids. Its efficacy depends on its coagulation, which it entangles in its meshes the impurities with which it either ri to the surface or precipitates. When the liquid to be clarified does n spontaneously coagulate the albumen, it is necessary to apply he Bookbinders use the glaire as a varnish.

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[1] *Philosophical Transactions* for 1822, p. 377.

[2] *Nicholson's Journal*, ii. 246.

[3] *Philosophical Transactions*, 1822.

Class X. Mammalia, *Linnæus.*—Mammals.

Characters. — *Vertebrated* animals with red and warm *blood*, breathing thro *lungs*, *viviparous*, and suckling their young with milk formed in their breasts *mammæ*.

Order I. CETACEA, *Linnæus.*—THE CETACEANS.

Characters. — *Body* pisciform, terminated by a caudal appendage, cartilagino and horizontal. Two anterior extremities formed like *fins*, having the bones whi form them flattened and very soft. *Head* joined to the body by a very short thi neck. Two pectoral or abdominal *mammæ*. *Ears* with very small external openin *Brains* large. *Pelvis* and *bones* of the posterior extremities represented by two ru mentary bones lost in the flesh.

381. PHYSETER MACROCEPHALUS, *Linn. L. E.*—GREAT HEADED CACHALOT.

(Concretum e materie oleosâ capitis comparatum, *L.*—Cetine nearly pure, *E.*—Cetaceum, *D.*

History. — Cuvier[1] is of opinion that this animal is perhaps th *Physeter* of Pliny,[2]—the *Orca* of some other Latin writers.

Zoology. **Gen. Char.** — Inferior *teeth* eighteen to twenty-three o each side of the jaw. *Upper jaw* broad, elevated, without teeth, or with these short and concealed in the gum; *lower jaw* elongated, narrow, corresponding to a furrow of the upper, and armed with thick and conical teeth entering into corresponding cavities in the upper jaw. *Spiracular orifices* united at the upper part of the snout. A *dorsal fin* in some species, a simple eminence in others. *Cartilaginous cavities* in the superior region of the head, filled with *oily matter.*

Sp. Char. — Lower *teeth* twenty to twenty-three on each side, recurved and pointed at the extremity. Small conical teeth concealed in the upper gums. *Tail* narrow and conical. *A longitudinal eminence* on the back above the anus. Upper part of the body blackish or slate blue, a little spotted with white. *Belly* whitish. *Length* forty-five to sixty feet.

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[1] *Rech. sur les Ossemens Foss.* v. 328.

[2] *Hist. Nat.* ix. 3, and xxii. 53, ed. Valp.

The *snout* of the cachalot, notwithstanding its prodigious length, is formed only by the maxillæ on the sides, by the intermaxillæ towards the median line, and by the vomer on this line. The intermaxillæ project to form the anterior part of the snout. Posteriorly the right one ascends higher than the left. The *spout hole* is single (in most cetacea it is double), and directed towards the left side, so that whenever the animal spouts water, it is to that side only.

SEAT OF SPERMACETI.—Spermaceti is found in several parts of the body of the animal, mixed with common fat. The head, however, is the grand reservoir for it. Here it is found (mixed with oil) in a large excavation of the upper jaw, anterior to, and quite distinct from, the true cranium which contains the brain. Mr. Hunter[1] states that the spermaceti and oil are contained in cells, or cellular membrane, in the same manner as the fat in other animals; but that besides the common cells there are larger ones, or ligamentous partitions going across, the latter to support the vast load of oil, of which the bulk of the head is principally made up.

There are two places in the head where this oil lies; these are situated along its upper and lower part; between them pass the nostrils, and a vast number of tendons going to the nose and different parts of the head. The purest spermaceti is contained in the smallest and least ligamentous cells. It lies above the nostril, along the upper part of the head, immediately under the skin and common adipose membrane. These cells resemble those which contain the common fat in the other parts of the body nearest the skin. That which lies above the roof of the mouth, or between that and the nostril, is more intermixed with a ligamentous cellular membrane, and lies in chambers whose partitions are perpendicular. These chambers are smaller the nearer to the nose, becoming larger towards the back part of the head, where the spermaceti is more pure.

Mr. Hunter discovered about the nose, or posterior part of the nostril, a great many vessels having the appearance of a plexus of veins, some as large as a finger. On examining them, they were found loaded with spermaceti and oil; and some had corresponding arteries. They were most probably lymphatics, whose contents had been absorbed from the cells of the head.

Hab.—Pacific Ocean, Indian and Chinese Seas. Especially off New Guinea and parts adjacent, Timor, Australasia, Polynesia, Peru, &c.

EXTRACTION OF SPERMACETI.—In the right side of the nose and upper surface of the head of the whale is a triangular-shaped cavity, called by the whalers "the case." Into this the whalers make an opening, and take out the liquid contents (oil and spermaceti) by a bucket. The dense mass of cellular tissue beneath the case and nostril, and which is technically called "junk," also contains spermaceti, with which and oil its tissue is infiltrated. The spermaceti from the case is carefully boiled alone, and placed in separate casks, when it is called "*head matter*."[2]

PURIFICATION.—The substance called "*head matter*" consists of spermaceti and sperm oil. Its colour is yellow. Its consistence varies with the temperature. In cold weather it consists of a congealed mass (spermaceti) surrounded and infiltrated by oil. To separate the latter as much as possible, it is put into filter bags. The solid thus obtained is then submitted to compression in hair bags, placed in an hydraulic press. It is then melted in water, and the impurities are skimmed off. Subsequently it is remelted in a weak solution of potash. It is then fused in a tub by the agency of steam, ladled into tin pans, and allowed slowly to concentrate into large, white, translucent, crystalline masses.

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[1] *Philosophical Transactions*, lxxvii. 390.

[2] Beale, *Natural History of the Sperm Whale*, p. 186, 1839; also, F. D. Bennett, *Narrative of a Whaling Voyage round the Globe*, from the year 1833 to 1836, ii. 153 and 228, Lond. 1840.

PROPERTIES. — Commercial spermaceti (*cetaceum; sperma ceti*) usually contains a minute portion of sperm oil, which is best removed by boiling in alcohol. [The Cetine or pure spermaceti is dissolved, and is deposited on cooling in a crystalline mass. This process should be repeated so long as the alcohol extracts any oil. — ED.] Absolutely pure spermaceti (called *Cetine*) is a white laminated substance, without taste, and almost odourless. By the addition of a few drops of alcohol or almond oil, it may be reduced to powder. [It is crystalline, has a bright pearly lustre, and melts at 120°. At 670° it is sublimed unchanged.—ED.] It is insoluble in water, and slightly soluble only in alcohol, even at a boiling temperature. [When distilled at a high temperature it is converted chiefly into ethalic or cetylic acid, and *cetène*, a liquid hydrocarbon having the formula $C^{32}H^{32}$. By carefully regulating the temperature these two products alone are formed. When saponified by fusion with caustic potash, it yields cetylate of potash and *ethal* ($C^{32}H^{33}O$) or hydrated oxide of cetyle. No oleate or margarate of potash is produced as was formerly supposed. According to L. Smith purified spermaceti or cetine is a cetylate of oxide of cetyle, the oleic acid formerly found being derived from a portion of sperm oil adhering to the spermaceti.—ED.]

COMPOSITION. — The ultimate analysis of pure spermaceti or cetine was made by Chevreul.[1] The proximate composition of the same substance has been ascertained by Dumas and Peligot.[2]

Chevreul's Analysis.	
Carbon	81·660
Hydrogen	12·862
Oxygen	5·478
Cetine	100·000

Dumas and Peligot's Analysis.	*Atoms.*			*Atoms.*
Margaric acid	2	or	Margarate of cetine	2
Oleic Acid	2		Binoleate of cetine	4
Cetene	3		Water	3
Water	3			
Cetine	1	or		1

[The researches of L. Smith and others have shown that the analysis of Dumas and Peligot must have referred to an impure specimen of spermaceti, *i. e.* a specimen from which the oil had not been entirely separated. The formula of cetine or pure spermaceti, on Liebig's authority, is $C^{64}H^{64}O^{4}$. This corresponds to one equivalent of oxide of cetyle ($C^{32}H^{33}O$) and one equivalent of cetylic acid ($C^{32}H^{31}O^{3}$). This formula at once explains the products obtained by its saponification and distillation. By distillation at a high temperature, the ethal $C^{32}H^{33}O$ loses 1 equivalent of water and becomes cetene, while the cetylic acid takes up the equivalent of water, and is distilled over as hydrated cetylic acid. — ED.]

PHYSIOLOGICAL EFFECTS AND USES.—Emollient and demulcent. Internally it has been employed in irritation and inflammation of the alimentary canal (as diarrhœa and dysentery) and of the bronchial membrane (catarrh); but its internal administration is now nearly obsolete. Its principal medicinal use is in the preparation of cerates and ointments.

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[1] Gmelin, *Handb. d. Chem.* ii. 440.

[2] *Ann de Chim. et de Phys.* lxxii. 5.

ADMINISTRATION.—When employed internally it is generally exhibited in the form of an emulsion (*spermaceti mixture*) made with the yelk of egg. It may be made with mucilage.

1. **CERATUM CETACEI**, L.; *Ceratum simplex*, E.; *Unguentum Cetacei*, D.; *Spermaceti Serate.* (Spermaceti, ℥ij.; White Wax, ℥viij.; Olive Oil, Oj. *L.*—Olive Oil, 6 parts; Bleached Bees'-wax, 3 parts; Spermaceti, 1 part, *E.*—White Wax, lb. ss.; Spermaceti lb. j.; Prepared Hogs' lard, lb. iij., *D.* "Heat the oil gently, add the wax and spermaceti, stir the whole briskly when it is fluid, and continue the agitation as it cools," *E.*)—If cold oil be added to the wax and spermaceti, the preparation is apt to be somewhat lumpy. As the white wax of commerce is always largely mixed with spermaceti, this preparation has never the precise composition intended by the College. Practically, however, this is of no consequence.—The preparation is employed as a mild and simple dressing for blisters and excoriated surfaces.

2. **UNGUENTUM CETACEI**, L.; *Spermaceti Ointment.* (Spermaceti, ℥v.; White Wax, ʒxiv.; Olive Oil, Oj. Having melted them together with a slow fire, stir assiduously until they become cold.)—A softer preparation than the preceding, but used in the same cases.

AMBERGRIS.—The substance called Ambergris (*Ambra grisea*) is procured from the Cachalot or Sperm Whale.[1] In this country it is used as a perfume only; on the continent it is employed in medicine. It appears to be the indurated fæces (perhaps somewhat altered by disease) of the animal. Mr. Beale[2] collected some of the semifluid fæces, and found that the dried mass had all the properties of ambergris. It is a solid, opaque, greyish, striated substance, having a pleasant musk-like odour, and which is supposed to be derived from the Squid (*Sepia moschata*) on which the animal feeds; and in support of this opinion it must be mentioned that the horny beaks of this animal are found imbedded in the masses. Its sp. gr. is 0·908 to 0·92. John analysed it, and found it to consist of *a peculiar non-saponifiable fat* (*ambreine*) 85, *sweet balsamic alcoholic extract, with benzoic acid*, 2·5, *aqueous extract, benzoic acid*, and *chloride of sodium* 1·5. *Ambreine* is soluble in alcohol, and by the action of nitric acid furnishes a peculiar acid called *ambreic acid.* The *effects* of ambergris on the system are said to be analogous to those of musk. In the shops is kept an alcoholic tincture (called *essence of ambergris*) which is employed as a perfume only.

[CERATUM LABIALE.—*Pharm. Norveg. Lip Ointment*, or *Lip Salve.*—Take of White Wax, fourteen parts; of Spermaceti, twenty parts; of the fixed Oil of Almonds, forty parts. Add to these substances, melted in a water-bath, of Alkanet Root, coarsely powdered, six parts. When well digested, strain, and add of Essential Oil of Bergamot and of Lemons, each three parts. When well mixed and strained, it may be poured into paper boxes.—ED.]

ORDER II. RUMINANTIA, *Cuvier*.—RUMINANTS.

PECORA, *Linnæus*.

CHARACTERS.—No *incisors* in the upper jaw; in the lower usually eight; a vacant space between the incisors and molars, but in which, in some genera, are found one or

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[1] *Phil. Trans.* for 1783, lxxiii. 226.

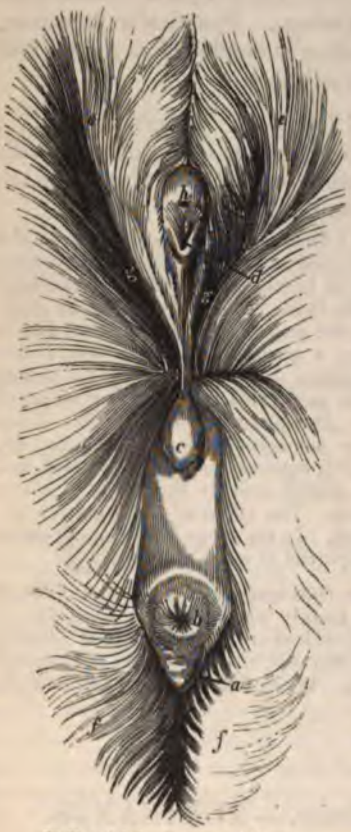
[2] *Op. supra cit.* p. 135.

two canines. *Molars* twelve in each jaw; the crown marked with two double cresce
of enamel, of which the convexity is outwards in the lower jaw, and inwards in
upper. No *clavicles.* *Extremities* disposed for walking. Two *toes* furnished w
hoofs; metacarpal bones united. Four *stomachs; intestines* long. Two or four ingui
mammæ. *Horns* in the males, and often in the females of most species.

382. MOSCHUS MOSCHIFERUS, *Linn. L. E. D.*—THE MUS ANIMAL.

(Concretum in folliculo præputii repertum, *L.*—Inspissated secretion in the follicle of the prepuce, *E. D.*)

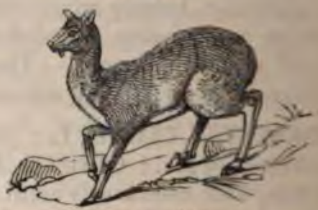
FIG. 124.



Belly of Moschus moschiferus.
(From Pallas.)

a. Tail. *b.* Anus. *c.* Scrotum. *d.* Preputial orifice. *e.* Abdomen. *h.* Orifice of the musk sac.

FIG. 125.



Moschus moschiferus.

HISTORY.— Aristotle, Pliny, Ælia
and Oppian, make no mention of th
animal. Ætius[1] is the earliest writ
who notices the perfume. None of th
etymologies hitherto given for the wor
Musk (μόσχος) are satisfactory.

ZOOLOGY. **Gen. Char.**—*Incisors*
Canines $\frac{1}{0}-\frac{1}{0}$. *Molars* $\frac{6}{6}-\frac{6}{6}=34$. *Ca-
nines* wanting altogether in the females
superior canines large in the male
Ears long, pointed. *Body* slender. *Fe*
with hoofs, separated and envelopin
the last phalanges. *Tail* very shor
Two inguinal *mammæ.*

Sp. Char.—*Fur* of a grey-brown; *ha*
coarse. A *pouch* before the prepuce o
the male, filled with an unctuous musk
substance. *Size* of the roebuck.

The absence of *horns* and the presenc
of canine teeth distinguish the anima
from the Deer (*Cervus*). The *Styloceru
moschatus* is the connecting link betwee
the deer and the musks. It has th
horns of the one, and the canine teeth
of the other.

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[1] *Serm.* xxvi. t. ii. cap. cxiii.

The most interesting part of the musks is the *preputial musk sac.* Cuvier[1] says no other species of Moschus possesses a musk sac; but this statement is not correct. *M. Altaïcus,* Eschscholtz (*M. Moschiferus Altaïcus,* Brandt), *M. Napu,* and *M. Javanicus,* are also said to possess musk sacs.

ANATOMY OF THE MUSK SAC.—The sac is peculiar to the male animal. If he be supposed to be laid on his back, and the belly examined, we observe behind the navel, and immediately in front of the preputial orifice, a small aperture (*external aperture of the musk sac*) leading into the *musk canal,* which terminates in the cavity of the *musk sac.* The aperture is about half an inch from the umbilicus, and usually about a line, or a line and a half, from the preputial orifice. In some preparations in my possession the distance is much greater. The preputial orifice is somewhat more prominent, and has a number of longish hairs projecting from it, in the form of a brush or hair-pencil; whereas the external musk aperture is placed in a depression and is smooth.

The *musk sac* is of an oval form, rather broader at the anterior than at the posterior part. It is flat and smooth above, where it is in contact with the abdominal muscles, but convex below (supposing the animal standing). Its breadth is from 1¼ to 1¾ inches; its length from 2 to 2½ inches; its depth varies, being greatest anteriorly, where it is about one-half or 3-4ths of an inch. The *external aperture* of the musk sac is placed in the median line, but nearer to the anterior than the posterior extremity of the sac. The *musk canal* is about 1 or 1½ lines long, its diameter being about one line. The *internal aperture* of the musk sac is surrounded by fine hairs, which readily fall off, and are found in the musk of commerce. The following are the parts of which the musk sac consists:—

1. *Outer or hairy coat or skin.*—This is a continuation of the hide, and covers the convex portion of the sac. Its hairs are stiff but smooth, and disposed in a circular manner around the external musk orifice.

2. *Muscular coat.*—This consists of two strata of fibres which surround the sac in a circular form. Pallas[2] states that they arise from the groin and unite anteriorly with the panniculus carnosus. He regards them as the compressors and retractors of the follicle and of the prepuce when the genital organ is thrust out. The same naturalist has described two retractors of the penis.

Between the two strata of muscular fibres is placed the *penis,* which is remarkable from the circumstance of the urethra projecting beyond the extremity of the glans. In its usual state the penis lies rolled up within the belly.

On the inner surface of the muscular fibres is a number of small oblong or roundish *glands,* compared by Pallas to the meibomian glands of the palpebræ.

3. *Fibrous coat.*—This is the most external of the proper coats of the musk sac. On its inner surface are numerous depressions or cells, surrounded by ramifying folds, within which the blood-vessels ramify. This coat is continuous (through the musk orifice) with the corium.

4. *Pearly coat.*—A soft delicate membrane, shining like mother of pearl. It lines the cells, and covers the folds of the fibrous coat.

5. *Epidermoid coat.*—It is the inner lining of the sac. Its external layer is silvery white; its internal one yellowish or reddish-brown.

6. *Musk glands.*—In each of the depressions observed on the internal coat of the musk sac are found two or more irregular shaped bodies of a yellowish or reddish-brown colour. These bodies consist of a central brownish mass (supposed to be glandular), covered by a fine membrane.

7. *Contents of the Musk sac.*—Pallas found, that, in young animals, the sac was empty and contracted. In the adult animal it contained about a drachm and a half of musk, and in old animals more than two drachms. But these quantities must be below the average, since the dried pods of commerce contain on the average more musk than this. Mr. Campbell[3] describes the musk found in the sac as soft, reddish-brown, granular, and having the appearance of soft ginger-bread.[4]

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[1] *Règne Animal,* nouv. édit. i. 259, 1829.

[2] *Spicileg. Zoolog.* fasc. xiii.

[3] *Journal of the Asiatic Society of Bengal,* vi. 119, Calcutta, 1827.

[4] For further details respecting the structure of the musk sac, consult Brandt and Ratzeburg, *Med. Zool.* Bd. i.

[Colonel Markham has communicated some interesting information respecting thi animal: — "Musk, which is much better known than the deer itself, is only foun in adult males; the females have none, neither has any portion of their bellies th slightest odour of musk. The dung of the males smells nearly as strongly as musk, bu singularly enough neither in the contents of the stomach, nor bladder, nor in any oth part of the body, is there any perceptible scent of musk. The pod, which is place near the navel, is composed of several layers of thin skin, in which the musk is con fined, and has much the appearance of the craw of a partridge or other small galli naceous bird when full of food. There is an orifice outwards through the skin, int which, by a slight pressure, the little finger will pass, but it has no connexion whatev with the body. It is probable that musk is at times discharged through this orific as the pod is often found not half full, and sometimes even nearly empty. The mus itself is in grains from the size of a small bullet to a small shot, of irregular shape, b generally round or oblong, together with more or less in coarse powder. When fres it is of a dark reddish-brown colour, but when taken out of the pod and kept for a length of time, it becomes nearly black. In autumn and winter the grains are fir hard, and nearly dry; but in summer they become damp and soft, probably from th green food which the animals then eat. It is formed with the animal, as the pod of young one taken out of the womb is plainly distinguishable, and indeed is much larg in proportion than in the grown up animal. For two years the contents of the p remain a soft milky substance, with a disagreeable smell. When it first becom musk, there is not much more than the eighth of an ounce; as the animal grows, increases in quantity; and in some individuals as much as two ounces are found. A ounce may be considered as the average from a full-grown animal; but as many of th deer are killed young, the pods in the market do not perhaps contain on an averag more than half an ounce. Though not so strong, the musk of young animals has much pleasanter smell than that of old ones: but difference of food, climate, or situa tion, does not, according to the writer, affect the quality."[1] —Ed.]

Hab.— Asia, between 16° and 58° north latitude, and 92° and 155° o east longitude: especially on the Atlas and Himalayan ranges. Chin Cochin-China, Tonquin, Tartary, and Siberia, have all been celebrate for the musk. The animal is timid, and dwells in cold mountainou districts, where coniferous plants abound. [It is essentially a fores animal, not unlike the hare in habits and economy. It is found in th Himalayas on every hill above 8000 feet, which is clothed with forest On the lower ranges it is comparatively rare.[2] — Ed.]

Capture of the Animals. — Various methods of catching th animals are adopted. Sometimes they are taken by snares or gins, sometimes by pitfalls, sometimes by shooting them. The Tungouses, one of the native tribes of Siberia, employ the bow and arrow only.

Description. — Three kinds of musk are described, viz. *Chin*, *Russian*, (or *Kabardine*) and *Bucharian*. I am acquainted with the tw first only.

1. China, Tonquin, or Thibet Musk (*Moschus tunquinensis* seu *tibetanus*).— This is imported in small rectangular boxes (*catties*), about $7\frac{3}{4}$ inche long, $4\frac{3}{8}$ inches broad, and $4\frac{1}{2}$ deep; covered externally by silk, and line with sheet-lead and paper. These boxes contain about twenty-five sac or pods, each wrapped separately in paper. On the outside of the lid o some of the boxes is marked "*Lingchong Musk*;" and on the inside of th lid is a rude Chinese representation of the musk hunters, some shootin the animal, others cutting out the musk-bag. On the paper, which en- velopes each pod, are similar rude representations in blue or red ink.

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[1] See *Pharmaceutical Journal*, vol. xv. p. 472.

[2] *Markham's Journal*, 1854.

Pod musk (*moschus in vesicis*) consists of roundish, or somewhat oval pods, which are generally broader at one end than at the other. The hairs are brownish yellow, or greyish or whitish, bristle-like, and stiff; arranged in a concentric manner around the orifice of the sac. A careful examination will always discover the remains of the penis. The pods are about 2½ inches long, and 1¾ inches broad. The weight of each pod, as well as of the contained musk, is very variable. I am indebted to Mr. Noakes, druggist, of Snowhill, for the following account of the weight of six pods, and of the grain musk obtained therefrom: —

Pods of Musk.	*Weight.*				*Contents.*
1	5½	drachms	0	grains	Grain Musk......16 drachms 15 grains.
1	4½	„	0	„	
1	8	„	37½	„	
1	9	„	47½	„	
1	5	„	20	„	
1	3½	„	0	„	
Total...6	37		15	„	16 „ 15 „
Average. 1	6	„	12½	„	2 „ 42½ „

Grain musk (*moschus in granis; moschus ex vesicis*) is granular, unctuous to the feel, mixed with hairs, of a dark reddish-brown colour, a bitter aromatic taste, and a strong, remarkable, very persistent smell (*musky odour*). Its odour can scarcely be called peculiar, since it is common to several animals and vegetables. Thus, the musk-ox and the musk-cat evolve it. The submaxillary gland of the crocodile secretes an unctuous musky substance. Among plants, Mimulus moschatus, Erodium moschatum, Malva moschata, and Centaurea moschata, may be referred to as possessing a musky odour. When mixed with other scents, musk has the remarkable property of augmenting and improving their smell, without much imparting its own: hence it is extensively used by perfumers. A few drops of potash added to musk increases its odour, by setting free, it is supposed, ammonia.

2. Siberian, Russian, or Kabardine (Caberdine) Musk (*Moschus sibiricus rossicus* seu *cabardinus*). This is an inferior kind. The pods are said to be more oblong or oval than those of the China kind; the hairs longer and whiter. But I have examined large quantities of Siberian musk, the pods of which are not distinguishable from those of the China by any of these characters. The only invariable distinction I have observed is in the scent, which is remarkably different: it is much less powerful and more nauseous and disagreeable, being somewhat empyreumatic. [Dealers, we are informed, rely upon another difference, namely, the greater length of the Cabardine compared with the China (Tonquin) pods.—ED.] Geiger says, it is sometimes accompanied by an odour somewhat similar to that of the sweat of a horse. This kind of musk is imported in wooden boxes, and all the pods that I have examined were in a good state of preservation; but frequently, I am told, this is not the case.

BUCHARIAN MUSK (*Moschus bucharicus*) is described by some pharmacologists, but I have never met with it. The hairs are said to be yellowish or reddish-brown. The musk has a weak odour, and is of very inferior quality.

ADULTERATION.—The great sophisticators of musk are the Chinese. I have seen several *artificial* pods of musk which had been imported from

Canton. T. W. C. Martius[1] calls this artificial kind *Wampo Musk,* an says that, for some years past, it has been extensively introduced int commerce. The hairy portion of the sacs is formed of a piece of th skin of a musk animal (readily distinguishable by its remarkable hairs coarsely sown at the edges to a piece of membrane, which represents th smooth or hairless portion of the sacs. These pods are distinguished fro the genuine ones by the following characters:—the absence of an aperture in the middle of the hairy coat; the hair not being arranged i a circular manner; and the absence of remains of the penis (found i every genuine musk sac). These false sacs, as well as the genuine one are sometimes enveloped in papers marked "*Musk collected in Nankin b Jung-then-chung-chung-kee.*" The odour of the musk of the false sacs ammoniacal. *Grain musk* is sometimes imitated by dried blood, an perhaps by other substances. The fraud is to be detected by a carefu examination of the appearance and odour of the particles, and by the chemical characters. An infusion of genuine musk gives *no* precipitat with a solution of bichloride of mercury, but does with tincture of nu galls, and acetate of lead. By incineration genuine musk leaves behin a greyish white ash, whereas blood yields a reddish one. *Artificial mu* is said to be prepared by rubbing in a mortar dried bullock's blood wit caustic ammonia, and mixing the half-dried musk with genuine musk [According to Markham, "the substances commonly used for adulter ation, or to fill the counterfeit pods, are:—blood boiled or baked on th fire, then dried, beaten to powder, kneaded into a paste, and made int grains and coarse powder to resemble genuine musk; a piece of the live or spleen, prepared in the same manner; dried gall and a particular par of the bark of the apricot tree, pounded and kneaded as above. Th dried paste from which common oil has been extracted, called 'peena' i also used; and lumps of this are often, without further preparation thrust into a pod through the orifice in the skin, in order to increase th weight. Sometimes no care is taken to give the material employed i filling a counterfeit pod, even the appearance of musk. A gentleman once showed me a pod he had bought from a Pubarrie at Missourie (th musk deer country). On my telling him it was counterfeit, he cut i open, and found it filled with hookah tobacco!"[2]—Ed.]

Commerce.—At an average of the three years ending with 1832, th imports of musk from all places eastward of the Cape of Good Hope with the exception of China, amounted to 4,965 ounces a year.[3] In 1839, duty (6d. per ounce) was paid on 2,389 ounces.

Composition.—In 1803, Thiemann[4] analysed musk. In 1805 Bucholz[5] examined it. In 1820, Blondeau and Guibourt[6] published an analysis of it. Afterwards, Westler,[7] Buchner,[8] and Geiger and Reinmann,[9] submitted it to chemical investigation.

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[1] *Lehrb. d. pharm. Zool.* S. 39, 1838.
[2] *Pharmaceutical Journal,* vol. xv. 475.
[3] M'Culloch's *Dictionary of Commerce.*
[4] *Berl. Jahrb.* S. 100, 1803.
[5] Pfaff, *Mat. Med.* iv. 401.
[6] *Journ. de Pharm.* vi. 105.
[7] Buchner's *Rep.* xvi. 222, 1824.
[8] *Ibid.* xxii. 152, 1825.
[9] Gmelin, *Handb. d. Chem.* ii. 1449.

Guibourt and Blondeau.

1.	*Volatilised by drying.* { Water	46·925
	{ Ammonia	0·325
2.	*Extracted by ether*—Stearine, oleine, cholesterine, fatty acid with ammonia, traces of a volatile oil.	13·000
3.	*Extracted subsequently by alcohol*—Cholesterine, fatty acid with ammonia, sal ammoniac, chlorides of potassium, sodium, and calcium, and an undetermined acid combined with the same bases	6·000
4.	*Extracted subsequently by water*—Gelatine, carbonaceous matter soluble in water, the preceding chlorides, and an undetermined combustible acid	19·000
5.	*Extracted subsequently by ammonia*—Albumen and phosphate of lime.	12·000
6.	Fibrous tissue, carbonate and phosphate of lime, hairs, and sand	2·750
		100·000

Geiger and Reinmann.

1.	Peculiar volatile substance	Quantity undeterminable.
2.	Ammonia	Ditto.
3.	Peculiar, fixed, uncrystallisable acid	Ditto.
4.	Stearine and oleine	1·1
5.	Cholesterine (with some oleine and resin)	4·0
6.	Peculiar bitter resin	5 0
7.	Osmazome and salts	7·5
8.	A mouldy-like substance, in part combined with ammonia and salts	36·5
9.	Sand	0·4
10.	Water, some volatile odorous matter, the above acid in part combined with alkaline salt, and loss	45·5
		100·0

ODOROUS PRINCIPLE.—Has not hitherto been isolated. The strong and diffusive odour of musk would lead us to expect that its odorous matter was highly volatile. Yet such is not the fact; for we cannot deprive musk of its peculiar odour by distillation, though the distilled liquid has a musky smell. As it is destructible by heat, it is obviously organic. It is not peculiar to musk, since many other substances exhale an analogous odour. Some have suggested that it is the result of putrefaction of one or more of the constituents of musk; and in support of this statement it is asserted that, by Leslie's method of desiccation, musk may be dried and rendered odourless. I have repeatedly performed this experiment with every care, but without obtaining odourless musk. Robiquet was of opinion that many odorous substances owed their odour to a certain quantity of ammonia, which, being disengaged, carried off with it substances not otherwise volatile, which masked the ammoniacal smell. In applying this hypothesis to musk, it must be admitted that it harmonizes well with several of the circumstances observed. Thus musk evolves ammonia; water distilled from musk contains ammonia; and potash added to a solution of musk heightens its odour (by facilitating the evolution of ammonia?).[1]

PHYSIOLOGICAL EFFECTS.—Musk disturbs the functions of the stomach, acts as a stimulant to the vascular system and brain, and afterwards proves narcotic. Jörg[2] and his pupils submitted themselves to its influence in doses of from 2 to 15 grains in water or mixed with magnesia. Its primitive effects were eructation, weight at the stomach, diminution or increase of appetite, dryness of the œsophagus, heaviness of the head, vertigo, and headache. The secondary effects were more marked on the encephalon than on the digestive canal: disposition to sleep, faintness, and a feeling of heaviness in the whole body. Lastly, deep and long-continued sleep. In very large doses the action on the nervous system was very marked; trembling in the limbs, and even convulsions, were observed. The pulse was increased in frequency, and somewhat fuller. These effects show that musk belongs to the cerebrospinants. It is a stimulant to the nervous and vascular systems, and an irritant to the stomach. Its effects are by no means uniform. Trousseau and Pidoux[1] suffered from its use neither excitement of the vascular system, nor sleep. Its influence is more manifest in some constitutions (those, for example, commonly termed nervous, in whom there is a very sensible or excitable condition of the nervous system), than in others (as the phlegmatic). Moreover, its effects are more marked in some morbid conditions of the cerebral functions (of the hysterical kind), than in the healthy condition of these functions. In some persons the nervous system appears to be peculiarly susceptible of the odour of musk; for it is reported that headache, giddiness, and even fainting, have been induced by it. When the digestive apparatus is previously in a state o irritation, musk increases the local disorder, giving rise to pain, nausea vomiting, and diarrhœa. Sometimes the stimulant influence of musk i directed to the sexual organs. Trousseau and Pidoux[2] experienced from it "une assez vive excitation des organes génitaux." In the female i has occasionally provoked the catamenial discharge. In persons disposed to epistaxis it has at times appeared to bring on the hemorrhage. Occasionally diaphoresis or diuresis has seemed to result from its use.

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[1] Even after a century, musk, if originally good, retains its odour. The author examined some in the possession of Mr. Ince of the date of 1745, *i. e.* 100 years old. It was in small cohesive masses, and had a powerful and delightful odour. Is this the kind described as being scarce, and which the animal is said to squeeze out by pressure against stones? Mr. Ince has also some sixty years old: this is very inferior.

[2] *Material zu einer Arzneimittell.* Leipsig, 1825; and *Lond. Med. Gaz.* xxvi. 952.

The odorous principle of musk is absorbed, and subsequently thrown out of the system by the excretories. Barbier[3] observes that the urine and the sweat of persons who have taken this substance are powerfully impregnated with its odour—now and then so strongly, that the hand, applied for the purpose of feeling the pulse, retains its odour for some time. On postmortem examination, the brain, and the cavities of the chest and abdomen, in those who have taken it during life, sometimes emit a strong smell of musk. Tiedemann and Gmelin[4] recognised the odour of musk in the blood of the mesenteric, splenic, and portal veins; but they failed to detect it in the contents of the lacteals. Trousseau and Pidoux mention that in their experiments the excretions acquired a feeble odour of musk. Jörg, however, denies that the excretions of those who have taken musk have the smell of this substance.

USES.—The effects of musk, already alluded to, show that it is a remedy which will be useful where we want to excite the nervous system; and *vice versâ*, that it will be hurtful where there exists a determination of blood to the brain, and in those constitutions denominated plethoric. The cases in which experience seems to have shown that musk is sometimes useful are the following:—

1. Those diseases which are attended with convulsive movements, and which, therefore, are called *spasmodic*. Such, for example, as hysteria, epilepsy (especially of children, and where the disease does not depend on organic changes, or on plethora), chorea, and even in some cases of tetanus. The employment of musk here has led to its denomination of antispasmodic.

Dr. Cullen,[5] on whose practical information I place great reliance, says, "I maintain that musk (when genuine) is one of the most powerful antispasmodics that we are acquainted with. I have found it, with Dr. Wall, to be a powerful remedy in many convulsive and spasmodic affections, and in some of a very peculiar kind. I had once a gentleman affected with a spasm of the pharynx, preventing deglutition, and almost respiration. This, when other remedies had failed, was relieved by the use of musk, which often showed its power; for the disease continued to recur at times for some years after, and was only obviated or relieved by the use of musk."

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[1] *Traité de Thérap.* i. 25.

[2] *Op. supra cit.*

[3] *Traité Elém. de Mat. Méd.* 2d edit. ii. 143, 1824.

[4] *Vers. üb. d. Wege auf welch. Subst. ins Blut gelang.* S. 63, 69, 71, 73, 1820.

[5] *Mat. Med.*

2. In *low fevers* which are accompanied with delirium, twitchings of the muscles, a small contracted pulse, and convulsions, musk has been occasionally employed, and with benefit. Like opium, its use in these cases is always uncertain; in one instance relieving, in another increasing the malady, though the cases may be to all appearances parallel.

3. In *retrocedent gout*, as where gout attacks the stomach or the head, giving rise to headache or delirium, musk has been found beneficial. Cullen relates a case where immediate relief was obtained by the exhibition of fifteen grains of genuine musk.

4. In the *delirium* which sometimes occurs in pneumonia, but which bears no relation to the intensity of the latter, and is accompanied with adynamia, Recamier[1] has found it beneficial.

5. Lastly, during the severe visitation of *malignant cholera*, musk was one of the remedies tried. I saw it employed several times but without obvious relief. The experience of others was various; but the result is, that the profession has formed a very low estimate of its power in this disease.

ADMINISTRATION.—Musk should be given in *substance*, either in the form of boluses, or suspended in water by means of saccharine or mucilaginous substances. Its dose is from eight to fifteen grains. In children it may be sometimes used in the form of enema.

ESSENCE OF MUSK, used as a perfume, is ordinarily prepared from the musk pods from which the grain musk has been extracted. The following formula has been furnished me, as one in common use:—Grain Musk, ʒxiv. (or Musk Pods, ℥vij.); Boiling Water, Oss. Digest until cold; then add, of Rectified Spirit, Ovjss.; Carbonate of Potash, ʒss. Digest.

383. CERVUS ELAPHUS, *Linn. L. E.*—THE STAG.

(Cornu, *L.*—Horn, *E.*)

HISTORY.—Both the hart and the hind (the male and female stag) are repeatedly mentioned in the Bible.[2] The stag is also noticed by Hippocrates, Aristotle, Pliny, Galen, and Avicenna.

ZOOLOGY. **Gen. Char.**—*Incisors* $\frac{0}{8}$, *canines* $\frac{0}{0}-\frac{0}{0}$, or $\frac{1}{0}-\frac{1}{0}$, *molars* $\frac{6}{6}-\frac{6}{6}=32$ or 34. *Canines*, when they exist, compressed and bent back. *Head* long, terminated by a muzzle. *Eyes* large, pupils elongated transversely. *A lachrymal sinus* in most. *Ears* large and pointed. *Tongue* soft. *Body* slender. Four inguinal *mammæ*. *Horns* solid, deciduous, palmated, branched, or simple, in the males; females, with one exception, without horns.

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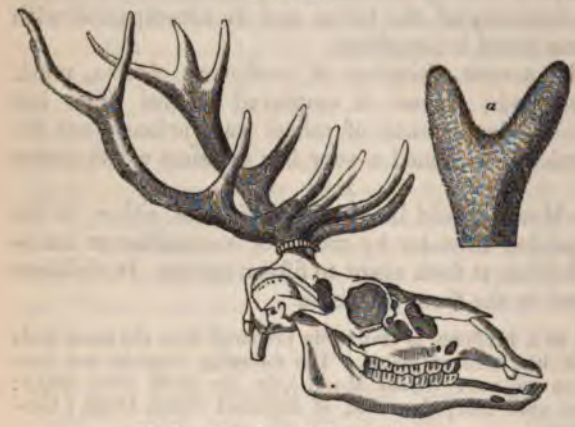
[1] Jacquet, *Biblioth. Méd.* lix.

[2] *Deut.* xiv. 5; and *Psalms*, xviii. 33.

Sp. Char.—*Horns* with three anterior antlers, all curved upwards, the summit forming a crown of snags from a common centre. *Lachrymal sinuses*. *Fur* red-brown in summer, brown-grey in winter. *A pale disc* on the buttocks.

The stag usually begins to shed his antlers in February or March, immediately after which their reproduction begins, and by July he has completely renewed them.[1] The first sensible phenomenon of the formation of these parts is the vascular excitement about the frontal bone. The arteries are observed to be enlarged, and to pulsate more strongly than usual; the heat is increased, and, in fact, all the symptoms of active inflammation come on. Very soon we perceive two cartilaginous tubercles, one on each side; these enlarge and elevate the skin, by which they acquire from the distension of the latter a velvety covering. These tubercles are soon converted into real bone; but the deposit of ossific matter does not stop here: it continues round the base of the antlers, thus giving rise to what has been usually termed the *burr*. These osseous prominences, the antlers, are supplied with two sets of vessels—an external or cutaneous, which is the most efficient, and an internal. By the pressure made on the former by the burr, they are obliterated: the covering of the antlers no longer receiving a supply of blood, soon ceases to live, dries up, and falls off. The internal vessels continue to keep up the life of the bone for a few months longer, when death takes place. This occurrence may be in part owing to the imperfect nutrition, and partly, perhaps, to the exposure of the bone to the air without any envelope; but it arises principally from some unknown changes in the vital actions. The antlers being now dead, nature soon sets about their separation. To effect this, the living parts at the base are rapidly absorbed, so that the antlers being left but slightly adherent

Fig. 126.



Skull and Antlers of Cervus Elaphus.

a. Crown of the antlers with the velvety covering.

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[1] The temporary existence of the antlers shows that they are for a temporary use. The period of their existence, and the stoppage of their growth by castration, points to the sexual functions for their use. No sooner are they fully formed than the males engage in the most deadly fights for the females. In the College of Surgeons are two fine heads with the antlers interlocked: the animals died starved.

to the frontal bone, readily fall off by a gentle knock. A few hours only elapse, before the irregularity on the surface of the os frontis is covered by a thin pellicle, and shortly afterwards the formation of a fresh pair of antlers is commenced. Castration stops the growth of the antlers.

HAB.—Europe, Asia, and North of Africa.

DESCRIPTION AND COMPOSITION.—The antlers of the stag are commonly called *hartshorn* (*cornu cervi* vel *cornu cervinum*). Though simply designated *cornu* (*horn*) in the London and Edinburgh Pharmacopœia, their composition is very different from that of the horns of the ox or the sheep, and which are sometimes called *true horn*. The latter consists principally of coagulated albumen; whereas hartshorn has the same composition as bone. According to Merat-Guillot[1] it consists of *soluble cartilage* (*gelatine*) 27·0, *phosphate of lime* 57·5, *carbonate of lime* 1·0, *water* and *loss* 14·5.

Hartshorn shavings or *raspings* (*rasura* vel *ramenta cornu cervi*) readily give out their gelatine by boiling in water.

PHYSIOLOGICAL EFFECTS AND USES.—Decoction of hartshorn is nutritive, emollient, and demulcent. It has been used in intestinal and pulmonary irritation. It is generally taken flavoured with sugar, lemon, or orange juice, and a little wine.

Hartshorn shavings are directed to be used in the manufacture of *Antimonial Powder*, but manufacturers generally substitute bone sawings.

Brewers sometimes employ decoction of hartshorn for fining beer and other liquors. It is preferable to isinglass on account of its cheapness. The gelatinous matter of bones being less soluble than that of antlers, bone sawings or shavings do not answer as a substitute for hartshorn.

1. CORNU USTUM was formerly a preparation of the Ph. L. but is now removed to the Materia Medica, and designated "Calcis phosphas *e cornu igne comparata*."

2. OLEUM ANIMALE EMPYREUMATICUM. *Empyreumatic Animal Oil.*—When animal substances (as bone or hartshorn) are subjected to destructive distillation, a fetid volatile oil is obtained, which is commonly called *Animal* or *Dippel's Oil*. That which is found in commerce is obtained in the manufacture of bone black. It is identical in its nature with the *Oleum Cornu Cervi*, or *Oil of Hartshorn*, formerly used in medicine. As usually met with, it is a thick, brown, viscid oil, having a most repulsive odour. By distillation, however, it may be rendered colourless and limpid, but is soon altered by the action of air and light. Its ultimate constituents are *Carbon*, *Hydrogen*, *Nitrogen*, and *Oxygen*. It contains ammonia, and therefore has an alkaline reaction. Unverdorben alleges that it contains four oily salifiable bases, to which he has given the names of *odorine*, *animine*, *olanine*, and *ammoline*. Reichenbach has obtained *creasote* from it, and ascribes to this principle the supposed virtues of animal oil. Whatever may be its active principle, animal oil is undoubtedly a very powerful agent. In large doses it acts as an energetic poison, operating in two ways, locally as an irritant, remotely as a narcotic.[1] Swallowed in moderate doses, it stimulates the vascular and nervous systems, and is esteemed antispasmodic. It has been employed as a local agent in bruises, gangrene, porrigo, and other diseases of the skin. Internally, it has been used to prevent an attack of epilepsy or ague, as a stimulant in low fevers, and as an antispasmodic in hysteria and other affections of the nervous system accompanied with convulsive movements. Bremser[2] used *Chabert's oil* (prepared by mixing three parts of oil of turpentine with one part of Dippel's oil and distilling three parts) as an anthelmintic in tape-worm. The dose of animal oil is a few drops, cautiously increased.

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[1] Quoted by Berzelius, *Traité de Chim.* vii. 643.

384. OVIS ARIES, *Linn. L. E.*—THE SHEEP.

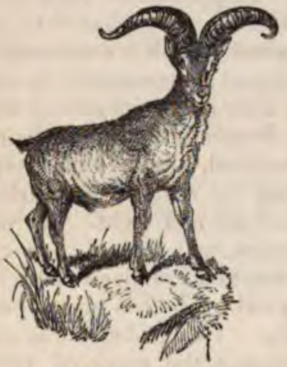
(Sevum ; Adeps præparatus, *L.*—Fat, *E.*)

HISTORY.—The sheep is one of the anciently known animals. It is mentioned by Moses,[2] by Herodotus,[3] Aristotle, and other ancient writers.

ZOOLOGY. **Gen. Char.**—*Incisors* $\frac{0}{8}$, *canines* $\frac{0}{0}$—$\frac{0}{0}$, *molars* $\frac{6}{6}$—$\frac{6}{6}$=32. *Horns* common to both sexes, sometimes wanting in the female, thick, angular, wrinkled transversely, pale coloured, turned laterally in a spiral form. *Ears* small. *Legs* slender. *Hair* of two kinds. *Tail* more or less short. Two *mammæ*.

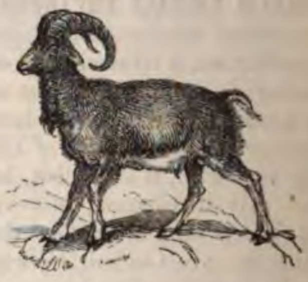
Sp. Char.—[*O. Musimon.*]—*Horns* very strong, arched backwards and curved downwards, and towards the point. General *colour* fawn, more or less brown, white on the face and legs, and under the belly ; a darker streak on the dorsal line, on the flanks, and often black about the neck.

FIG. 127.



Ovis Ammon.

FIG. 128.



Ovis Musimon.

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[1] Christison, *Treatise on Poisons.*

[2] *Traité sur les Vers Intestin.* Paris, 1824.

[3] *Genesis*, iv. 2.

[4] *Thalia*, cxiii.

The immense number of races of this animal in cultivation are well known; and it is now difficult, perhaps impossible, to determine its native condition. Modern zoologists, however, ascribe our domesticated sheep to *Ovis Ammon*, called the *Argali* of Siberia, or to *Ovis Musimon*, termed the *Mouflon* or *Muflon* of Sardinia.

Hab.—Domesticated everywhere.

DESCRIPTION.—Mutton suet (*sevum; adeps præparatus*) is the fat from the neghbourhood of the kidneys of the animals. It is prepared (*sevum præparatum*) by melting it over a slow fire, and straining through linen or flannel in order to separate the membranous portions.

COMPOSITION.—The *ultimate* analysis of mutton suet has been made by Chevreul and by Bérard.[1] The first of these chemists also ascertained its *proximate* composition.

Ultimate Analysis.	*Chevreul.*	*Bérard.*
Carbon	78·996	65·0
Hydrogen	11·700	21·5
Oxygen	9·304	13·5
Mutton Suet	100·000	100·0

Proximate Analysis.	
Stearine Elaine or Oleine	principally.
Margarin, a little.	
Hircin, a little.	
Mutton Suet.	

PHYSIOLOGICAL EFFECTS AND USES.—Like other fatty bodies, mutton suet is nutritious, but difficult of digestion. Its local effects are emollient and demulcent. In medicine it is used as a basis for ointments, cerates, and some plasters; being preferred, in certain cases, to hog's lard, on account of its greater consistence.

385. BOS TAURUS, *Linnæus.*—THE OX.

(Lac.)

HISTORY.—An animal very anciently known and highly valued. It is repeatedly mentioned by Moses.

ZOOLOGY. **Gen. Char.**—*Incisors* $\frac{0}{8}$, *canines* $\frac{0}{0}-\frac{0}{0}$, *molars* $\frac{6}{6}-\frac{6}{6}=32$. *Body* large. *Members* strong. *Head* large; forehead straight; muzzle square. *Eyes* large. *Ears* generally funnel-shaped. A fold of the skin, or *dew-lap*, on the under side of the neck. Four *mammæ;* tail long, tufted; horns, simple, conical, round, with different inflections, but often directed laterally, and the points raised.

Sp. Char.—*Horns* round, lateral arched, with the point turned outwards. *Face* flat, or a little concave. *Occipital crest* in the same line as the base of the horns. *Mammæ* disposed in a square form. *Hair* fawn-coloured, brown or black, not sensibly longer at the anterior than the posterior parts. About seven feet long.

MAMMARY GLANDS two, placed close together, and constituting the *udder*. Each gland consists of a number of *lobes*, made up of *yellowish* or *reddish soft granules*, which consist of very fine blood-vessels, nerves, and the commencement of the *milk* or *lactiferous ducts* (*ductus galactophori*) which unite to form 8 or 10 principal ducts, which open into the *large duct*, or *duct of the teat*. This tube is conical, and has a number of folds on its internal surface.

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[1] Gmelin, *Handb. d. Chem.* ii. 439.

Hab.—Domesticated everywhere.

Description.—Milk (*lac*), or to be more precise in our description, *cow's milk* (*lac vaccinum*), is an opaque, white, emulsive liquid, with a bland sweetish taste, a faint peculiar odour, and a sp. gr. of about 1·030: the latter property is subject to considerable variation. When recently drawn from the animal it is slightly alkaline. Subjected to a microscopical examination, milk is observed to consist of myriads of *globular particles* floating in a serous liquid. These globules are exceedingly minute: according to Raspail[1] the largest does not exceed in size the 0·0003937 (about 1-2500th of an inch). They instantly disappear by solution on the addition of a drop of caustic alkali. Both Donné[2] and Sir A. Cooper[3] have separated the globules by repeated filtration: the filtered liquor was transparent. The milk globules consist essentially of *butter*. Donné denies that they contain any casein, since they are soluble both in alcohol and ether, which do not dissolve this principle. Being specifically lighter than the liquor in which they are suspended, they readily separate by standing. They, therefore, rise to the surface, carrying with them some casein, and retaining some of the serum; thus forming what is called *cream*. The milk from which the cream is separated is termed *skimmed milk*.

Cream (*cremor lactis; flos lactis*) has a variable sp. gr. The average, perhaps, is 1·0244. The upper stratum of cream is richest in butter, the lowest in casein. By agitation, as in the process termed *churning*, the fatty globules unite to form *butter* (*butyrum*); the residue called *butter-milk* (*lac-butyratum*), consists of casein, serum, and a little butter.

Skimmed milk, like cream, has a variable sp. gr.; perhaps the average may be taken at 1·0348. If left to itself it readily acquires acid properties, while white coagula, commonly termed *curds*, separate from it. If an acid or rennet (an infusion of the fourth stomach of the calf) be added to it, this change is immediately effected. The curd separated by the rennet is called *casein*. But after rennet has ceased to produce any more coagula, acetic acid will cause a further quantity to be formed. The curd thus separated by the acid is termed *zieger* or *serai*. The *whey* (*serum lactis*) left after the separation of the casein and serai, yields, on evaporation, sugar of milk, one or more nitrogenous substances, lactic acid, and some salts.

Composition.—Milk has been the subject of repeated chemical investigation.[4] The recent analysis of several kinds of milk, published by MM. O. Henry and Chevallier, has been already stated.

The following table shows the composition of several domestic preparations of milk:—

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[1] *Chim. Organ.*

[2] *London Medical Gazette*, xxv. 302.

[3] *On the Anatomy of the Breast*, 1840.

[4] See Berzelius, *Traité de Chim.* vii. 583.

					Constituents.
MILK	Cream	Butter	solid fat		1. *Stearine.*
			liquid fat		2. *Butyrine.* 3. *Oleine.*
		Butter-milk	casein		
			serum or whey		
	Skim-milk	Matters coagulable	by rennet		4. *Casein.*
			not by rennet, but by acetic acid		5. *Zeiger* or *Serai.*
		Whey or serum	saccharine matter		6. *Sugar of Milk.*
			azotised matter		7. *Osmazome.*
			salt	soluble in alcohol	8. *Alkaline and earthy lactates and phosphates.*
				soluble in water, not in alcohol	9. *Alkaline sulphate and phosphates.*
				insoluble in water	10. *Earthy and ferruginous phosphates.*

1. Casein or *Caseum; Albumen of Milk; Lactalbumen.*—An albuminous substance distinguished from the albumen of the egg and of blood by its not coagulating when heated, by its being coagulated on the addition of acetic acid, and by the products of its spontaneous decomposition. When dried it is yellowish and transparent, like gum: it is odourless, and has a very slight taste. It is soluble in water. If its solution be boiled in contact with the air it becomes covered with a white pellicle insoluble in water. The acids unite to form with it, when they are in excess, insoluble compounds. Various salts (as sulphate of copper, bichloride of mercury, nitrate of silver, bichloride of tin, &c.) form insoluble compounds with it. Its composition has been already stated.

2. Butter.—This well-known substance consists of three fatty bodies, *stearine*, *elaine* or *oleine*, and *butyrine*. The latter substance is characterised by yielding, by saponification, three volatile, odorous, fatty acids, viz. *butyric*, *capric*, and *caproic acids*. A small quantity of these acids exists in ordinary butter, especially when it has been exposed to the air, and gives butter its peculiar odour.[1]

3. Sugar of Milk; *Lactin; Saccholactin.*—Obtained from whey by evaporation. As used in commerce it occurs in cylindrical masses, in the axis of which is the cord which serves as the nucleus for the crystals. It is extensively made in Switzerland. Mr. Hess[2] has shown that, under certain conditions, sugar of milk is susceptible of fermentation, as was before inferred from the fact that the Tartars prepare a vinous liquid, called *Koumiss*,[3] from mares' milk. It is gritty under the teeth, and is very slightly soluble in alcohol. It is much less sweet, and less soluble in water, than common sugar. By the action of nitric acid it yields, like gum, saccholactic or mucic acid; so that it forms, as it were, a connecting link between sugar and gum. The composition of it, according to Prout, has been already stated. The formula of crystallised sugar of milk is $C^{24}H^{19}O^{19}+5$ aq. [Owing to its presence the oxide of copper is reduced by Trommer's test on boiling milk with sulphate of copper and potash. —Ed.]

4. Lactic Acid.—This, though stated by Berzelius to be a constituent of milk, is probably a product of its decomposition.

5. Salts.—Some of these are soluble in alcohol, as the lactates of potash (principally), soda, ammonia, lime, and magnesia; others are soluble in water, but not in alcohol, as sulphate of potash and the phosphate of potash and soda; lastly, the salts insoluble in water are the phosphates of lime, magnesia, and iron. The latter are held in solution in milk by the casein principally: but Berzelius says by the lactic acid also.

Characteristics of Good Milk.—The changes produced in the quality of milk by diseased conditions of the cows has attracted considerable attention in Paris, owing to the prevalence of a malady called the

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[1] For some remarks on the physical and microscopical characters of butter, by Turpin, see *Journ. de Chim. Méd.* 2nde sér. t. vi. p. 117.

[2] *Journ. de Pharm.* xxxiii. 498.

[3] Clarke's *Travels in various Countries of Europe*, i. 238, Lond. 1810. See also *Transactions of the Royal Society of Edinburgh*, vol. i.

cocote, among the cows in that capital.[1] The following are the essential morbid changes which have been recognised in milk:—want of homogeneousness, imperfect mobility or liquidity, capability of becoming thick or viscid on the addition of ammonia, and presenting, when examined by the microscope, certain globules (agglutinated, tuberculated, or mulberry-like, mucous or pus globules) not found in healthy milk.[2] Hence, then, good milk should be quite liquid and homogeneous; not viscid; and should contain an abundance of spherical transparent globules, visible under the microscope, soluble in alkalies and ether; should not become thick when mixed with ammonia; and should form a flocculent precipitate with acetic acid, but not be coagulated by heat alone. The relative quantity of cream afforded by milk is estimated by a graduated glass tube called a *lactometer*. [The test for the purity and goodness of milk is the microscope. By this instrument the number, size, and form of the oil globules may be determined.—ED.]

I have repeatedly submitted the milk supplied to me by a respectable dealer in this metropolis to examination by the lactometer, but the results have been most unsatisfactory, as the quantity of cream which I procured varied from 5 to 23 per cent. by measure. I have usually found the afternoon's milk to yield less cream than the milk supplied me in the morning. On one occasion I found 11·5 per cent. of cream in the morning milk, but only 5 per cent. in the afternoon milk. The milk of an Alderney cow yielded 17·5 per cent. of cream.

PHYSIOLOGICAL EFFECTS.—As a medicinal agent milk is regarded as a demulcent and emollient.

USES.—The *dietetical* uses of milk have been already noticed.

As a *demulcent*, milk is an exceedingly valuable substance in irritation of the pulmonary and digestive organs. It is an excellent sheathing agent in poisoning by caustic and acrid substances, and in some of these cases it acts as a chemical antidote; for example in poisoning by perchloride of mercury, sulphate of copper, bichloride of tin, and the mineral acids. Milk is further employed on account of its demulcent qualities in the preparation of the bread and milk poultice, which requires to be frequently renewed on account of the facility with which it undergoes decomposition, and acquires acrid qualities.

Milk is a constituent of the *Mistura Scammonii*, E.

Whey is an excellent diluent and nutritive. *Wine whey* (*serum lactis vinosum*) taken warm, and combined with a sudorific regimen, acts powerfully on the skin, and is a valuable remedy in slight colds and febrile disorders. I have already referred to the uses of *cream of tartar whey*, *alum whey*, and *tamarind whey*.

1. LACTIC ACID. $C^6H^5O^5+Aq$. Symbol=$\bar{L}$. This acid has been introduced into medicine by Magendie.[3] As it is one of the constituents of the gastric juice, he proposed its use in dyspepsia, and as it is a ready solvent of phosphate of lime, he suggested its employment in phosphatic deposits in the urine. An Italian physician[4] has more recently recommended it in gout, in consequence of its being a special solvent of the freshly precipitated phosphate of lime. It has been exhibited in the form of lozenges, or in solution in water flavoured with sugar. [Dr. O'Connor recommends its employment in dyspepsia as a more powerful agent than pepsine, in doses varying from half a drachm to two drachms in infusion of calumba.[1]—ED.]

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[1] See *Journ. de Pharm.* xxv. 301—318.

[2] *Recherches microscopiques sur divers laits obtenus de vaches plus ou moins affectées de la maladie qui a régné pendant l'hiver de* 1828 *à* 1839, *et designée vulgairement sous la dénomination de Cocote*, par M. Turpin, in the *Mémoires de l'Académie Royale des Sciences de l'Institut*, t. xvii. Paris, 1840.

[3] *Formulaire pour la préparation et l'emploi de plusieurs nouveaux medicaments*, Paris, 1835.

[4] *British and Foreign Medical Review*, ix. 239.

2. OX BILE (*Fel Bovinum* seu *Tauri*). Formerly extract of ox bile (*fel tauri inspissatum*) was employed in medicine as a tonic, and it has been recently re-introduced by a few practitioners in dyspeptic cases and biliary derangement. The dose of it is a few grains in the form of pills.

3. BILIS BOVINA SECCATA. *Pharm. Norveg.; Dried Ox-gall.*—Take of fresh Ox-gall two parts; of Alcohol (0·833), three parts. Mix thoroughly until coagulation has taken place; then filter and evaporate to dryness on a water-bath. The residue may be powdered.

[**4. PEPSINA**; *Pepsine; Medicinal Pepsine.*—Pepsine is the active principle contained in the digestive liquids prepared by the action of acidulated water on the mucous membranes of the stomachs of animals. It was discovered by Schwann; and Poppenheim, Wasmann, and Vogel, have published processes for procuring it. Vogel obtained it from the stomach of the pig, but it is now prepared in a purer form from the stomach of the calf or the sheep; that of the calf, according to our information, being preferable.[2] M. Boudault has lately published the following process:—The rennet-bags of the calf or sheep are well washed in water. The mucous surface is then removed by scraping, reduced to a pulp, and digested for twelve hours in water. The liquid is filtered, and the filtrate precipitated by a solution of acetate of lead. The pepsine is afterwards separated from the oxide of lead by a current of sulphuretted hydrogen. The pepsine is dissolved by the water, from which it is subsequently obtained by evaporation, under a temperature of 100°. In this state it has very much the appearance of dried mucus. It is neutral; and before it is fit for use it is necessary to add to it a certain quantity of acid, lactic acid being selected for this purpose. To render it more convenient for keeping and for administration, M. Boudault adds dried starch to the evaporated residue in such proportion that one part of the medicinal pepsine will have the power of digesting or dissolving four parts of fibrin at a temperature of about 98°.[3]

A specimen of medicinal pepsine which we have examined presented the following properties. It is a light powder, with a slightly yellowish tint. It is immediately rendered blue by iodine. When heated on platina it swells up, burns with a pale flame, evolving the smell of animal matter, and leaves a comparatively large carbonaceous ash. It forms a turbid solution with water (owing to the starch), froths readily on agitation, is not visibly changed by heat, and is not precipitated by acetic or nitric acid. The cold aqueous solution has a strongly acid reaction. It gives a precipitate with a solution of acetate of lead, but not with nitrate of silver. In the latter case there is no reduction of the salt of silver on boiling the mixture. It is dissolved by weak spirit, but is insoluble in absolute alcohol.

The digestive or solvent properties of this substance, like those of an ordinary ferment, are destroyed by a high temperature. At a heat above 120°, the solution of pure pepsine (free from starch) becomes turbid, and no longer exerts its solvent action on fibrin. This is no doubt, as Mr. Squire has suggested, one of the chief causes of failure in its preparation. Tannic acid and creasote precipitate it from its solution, and destroy its solvent properties. The special characters of pepsine are, that it coagulates milk and afterwards dissolves the coagulum.

A solution of pepsine, with chloride of sodium, is prepared by Mr. Morson, under the name of *Liquor Pepticus*, of which a teaspoonful is administered for a dose. Mr. Squire recommends that the *Liquor Pepsinæ* should be prepared by dissolving one drachm of pepsine in one ounce of distilled water. The solution does not keep.

Corvisart has lately suggested a *Syrup of Pepsine*, made by dissolving six parts of pepsine in twenty parts of cold water, and afterwards mixing it with seventy parts of the acidulated syrup of cherries.

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[1] *Med. Times and Gazette*, April 25, 1857, p. 409; also May 2, p. 445.

[2] [The reader will find an account of the physiological properties of pepsine, chymosine, and gasterase, in *Mialhe's Chimie Appliquée à la Physiologie et à la Thérapeutique*, 1856, p. 99.]

[3] [See Bouchardat's *Annuaire de Thérapeutique*, 1857, p. 130: also a paper by Mr. Squire in the *Pharmaceutical Journal*, for March, 1857, p. 472.]

In addition to these preparations, pepsine is also prepared in France, with medicinal doses of muriate of morphia, or codeia, as well as with strychnia, when the object is to restore the tonic powers of the stomach.

Medicinal Uses. — M. Corvisart has introduced this substance into medical practice as *Poudre Nutrimentive.* He has employed it in cases of disordered digestion from deficient or imperfect secretion of gastric juice, as well as in other forms of disease. Besides its use in cases of dyspepsia, we are informed that French practitioners have employed pepsine with benefit in patients recovering from typhoid and other debilitating fevers; cases in which the stomach, not having recovered its secretory powers, it is impossible to give much nutriment. It is stated to have been found serviceable in those cases in which, owing to long abstinence, food, when first taken, excites nausea and vomiting; but we have yet to learn how far the alleged good effects ascribed to this substance on the continent, will be borne out by the experience of practitioners in this country.

Dr. Sieviking has lately published the results of some experiments on the various preparations of pepsine recommended for medicinal use. He finds that the preparation above described, known as Boudault's pepsine, has the most powerful solvent action on hard-boiled white of egg, and that this action is increased by the addition of a small quantity of hydrochloric acid. The acidity of Boudault's pepsine is owing to the presence of lactic acid, but this is not in sufficient quantity to bring out its full solvent action. Under the microscope, it was found to consist chiefly of epithelium and starch granules.

The strength of the pepsine was tested by noting the loss in a given weight of coagulated albumen at a temperature of 110°. Dr. Sieviking found, as might be expected, that this chemical action has its limits; and he, therefore, considers it necessary that the quantity of food taken should be adjusted to the strength of the pepsine employed, or the complaint may be aggravated instead of being relieved.[1] It will be perceived from this statement, that there must be much uncertainty in the action of this compound; and when it is further considered, that in one set of experiments it required the long period of *twenty-four hours* in order that four grains of pepsine should dissolve four grains of hard albumen (increased to ten grains in another experiment by the previous addition of one drop of hydrochloric acid), it is obvious that small doses of this substance can have very little efficacy. Pepsine will no doubt receive a fair trial; but as few who use it will be either able or willing to test its qualities before employing it, we may expect that there will be many failures in its employment. It would be a complete bar to the prescription of a medicine if, on each fresh supply of a drug, a practitioner had to satisfy himself of its precise medicinal power; and in the absence of such trial, incur the risk of aggravating the disease under which his patient was labouring!—ED.]

ORDER III. PACHYDERMATA, *Cuvier.* — THE PACHYDERMS.

ESSENTIAL CHARACTERS.—The kinds of *teeth.* Four *extremities,* with the toes variable in number, and furnished with strong *nails* or *hoofs.* No *clavicles.* *Organs of digestion* not disposed for ruminating.

386. SUS SCROFA, *Linn. L. E. D.*—THE HOG.

(Adeps præparatus, *L.* — Fat, *E.* — Adeps suillus, *D.*)

HISTORY.—The hog is an animal very anciently known. By the Levitical law the Jews were forbidden to eat its flesh;[2] on account of either the filthy habits of the animal, or its supposed tendency to engender skin and other diseases, more especially leprosy. The Mahometans are also interdicted from eating it.[1]

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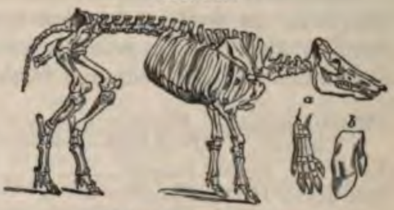
[1] [*Medical Times and Gazette,* April 4, 1857, p. 336.]

[2] *Levit.* xi. 7.

ZOOLOGY. **Gen. Char.**—*Incisors* $\frac{4}{6}$ or $\frac{6}{6}$; *canines*, $\frac{1}{1}$—$\frac{1}{1}$; *molars*, $\frac{7}{7}$—$\frac{7}{7}$; $=42$ or 44. *Canines* bent upwards and laterally; *molars* tuberculous; lower *incisors* bent forwards. Four *toes* on all the feet, the two middle ones only touching the ground, armed with strong *hoofs*. *Nose* elongated, cartilaginous. *Body* covered with bristles. Twelve *teats*.

Sp. Char.—*Tusks* strong, triangular, directed laterally. No *protuberance* under the eyes. *Colour* blackish-grey in the wild animal, but varying much in the domesticated races.

FIG. 129.



Skeleton of Sus Scrofa.

a. Foot with five hoofs.
b. Undivided hoof.

The varieties of this animal are almost innumerable. They are most conveniently reduced to the following:—

α. S. Scrofa ferus. The *wild hog*, or *wild boar*.

β. S. Scrofa domesticus. The *domesticated hog*, which varies in its form and colour.

δ. S. Scrofa pedibus monungulis. The hog with solid and undivided hoofs. This variety was noticed by Aristotle and Pliny.

Hab.—The temperate parts of Europe and Asia; the northern parts of Africa; America; the Islands of the South Sea, &c.

PREPARATION.—The fat of the animal is employed in medicine. That about the loins being firmer and denser than the fat of the other parts of the animal, is selected for medicinal use. In order to separate it from the membranes in which it is contained, it is melted over a slow fire, then strained through flannel or linen, and poured while liquid into a bladder, where it solidifies by cooling (*adeps præparatus*). Occasionally salt is added to preserve it; but unsalted lard should be employed for medical purposes. By melting in boiling water, lard may be deprived of any salt which may have been mixed with it. While solidifying, lard should be kept stirred, to prevent the separation of stearine and elaine.

PROPERTIES.—*Hog's lard* (*adeps suillus* vel *porci*) or *axunge* (*axungia*, so called from the use anciently made of it, namely, greasing the axle of a wheel,—*unguendi axem*) is at ordinary temperatures a white or yellowish-white solid. Its melting point varies from 78·5° F. to 87·5° F. In the liquid state it should be perfectly clear and transparent; but if it be intermixed with water it has a whitish or milky appearance. It should have little or no taste or odour. By exposure to the air, however, it acquires an unpleasant odour and acid properties. In this state it is said to be *rancid*. This condition is induced by the oxygen of the air (ozone), a part of which is absorbed, while a small portion of carbonic acid is evolved. As stearine does not become rancid in the air, while elaine does, the rancidity of lard is referred to the latter constituent. But it has been found that the purer the elaine the less readily does this change occur; whence it is assumed that some foreign substance in the elaine is the primary cause of rancidity, either by undergoing decomposition or by acting on the elaine.

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[1] [On the spread of disease from this food, and the probable diffusion of tænia depending on diseased pork, see a paper in the *Medical Times and Gazette*, May 2, 1857, p. 439.—ED.]

[Among the *adulterations* of this substance may be mentioned that pointed out by Mr. Whipple. This gentleman found some specimens of lard containing as much as 20 per cent. of farinaceous matter.[1]—Ed.]

Composition.—The *ultimate* composition of lard was ascertained by Chevreul,[2] as well as by Saussure and Berard. The first of these chemists also made a *proximate* analysis of rancid lard; and Braconnot determined the composition of fresh lard.

Ultimate Analysis—Chevreul.		*Proximate Analysis of Fresh Lard—Braconnot.*		*Proximate Analysis of Rancid Lard—Chevreul.*
				Stearine and elaine.
Carbon	79·098	Stearine...	38	Volatile non-acid matter having a rancid odour.
Hydrogen...	11·146	Margarine		Caproic (?) acid.
Oxygen......	9·756	Elaine or Oleine	62	Another volatile acid.
				Oleic, margaric, and perhaps stearic acids.
Lard...	100·000		100	Yellow colouring matter.
				Non-acid, non-volatile matter, soluble in water.
				Rancid Lard.

Physiological Effects.—Lard, like other animal fats, is nutritious, but very difficult of digestion. Its topical effects are demulcent and emollient. Both the flesh and fat of the hog have been long supposed to dispose to cutaneous disease; but it is no easy matter either to prove or disprove this opinion.

Uses.—In medicine lard is principally employed as a basis for unguents. It has been used, by friction, as an emollient; but the practice is now obsolete. In pauper establishments it is sometimes employed as a substitute for spermaceti ointment, to dress blisters; but the salt which lard sometimes contains, as well as the facility with which this fat becomes rancid, are objections to its use. It has sometimes occasioned considerable irritation.

Order IV. RODENTIA, *Cuvier*.—THE RODENTS.

Glires, *Linnæus*.

Essential Characters.—Two large *incisors* in each jaw, separated from the molars by a vacant space. No *canine teeth*. *Molars* with flat crowns or blunt tubercles. *Extremities*, the posterior longest, terminated by unguiculated *toes*, the number varying according to the species. *Mammæ* variable in number. *Stomach* empty. *Intestines* very long.

387. CASTOR FIBER, *Linn. L. E. D.* THE BEAVER.

(Castoreum; Folliculi præputii proprio humore repleti, *L.*—A peculiar secretion from the præputial follicles, *E. D.*)

History.—Castoreum was employed in medicine by Hippocrates, who considered it to have the power of acting on the uterus. It was an ancient opinion that the castor sacs were testicles, and that when closely pursued by the hunter, the animal tore them off, leaving them behind as a ransom.[1] This absurd notion [which is carried out in old plates on beaver hunting] seems to have been long ago disbelieved; for Pliny[2] tells us that Sextius derided it, and said it was impossible the animal could bite them off, since they were fastened to the spine. Thus was one error confuted by another; the truth being, the testicles are so placed in the inguinal region, on the external part of the *os pubis*, that they are not discernible until the skin is removed. Moreover, female beavers also have castor sacs.

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[1] *Pharmaceutical Journal*, vol. xii. p. 322.

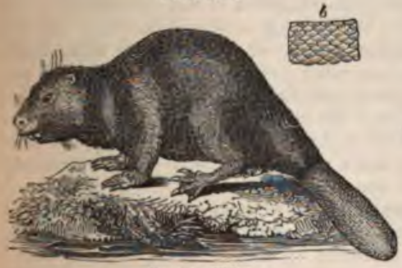
[2] Gmelin, *Handb. d. Chem.* ii.

ZOOLOGY. **Gen. Char.**—Incisors $\frac{2}{2}$, canines $\frac{0}{0}-\frac{0}{0}$, molars $\frac{4}{4}-\frac{4}{4}=20$. *Molars* composed of flat crowns, with sinuous and complicated ridges of enamel. Five *toes* on each foot, the anterior short and close, the posterior longer and palmated. *Tail* broad, thick, flattened horizontally, of an oval form, naked, and covered with scales (Stark).

Sp. Char.—*Fur* consisting of two sorts of hair, one coarse and brownish, the other downy more or less grey. About two feet long.

The ordinary *colour* of the animal is brown; but yellow, black, spotted, and white beavers, are met with. The two latter are very rare. Richardson[3] has never seen either of them, though he has met with black beavers which were kept as curiosities. The *tail* is remarkable for its scaly appearance. Its great breadth (oftentimes 5 inches) depends, not on the width of the caudal vertebræ, but on numerous strong tendons inserted into these vertebræ. *Incisor teeth* smooth, orange-coloured anteriorly, white posteriorly.

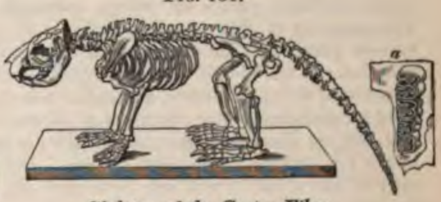
FIG. 130.



Castor Fiber.

b. Scales of the tail.

FIG. 131.



Skeleton of the Castor Fiber.

a. Molars of the upper jaw.

There is some reason for supposing that the European and American beavers are distinct species. The former are *burrowers*, the latter are for the most part *builders*.[4]

ANATOMY OF THE CASTOR SACS.—It has been before stated, that both male and female beavers are furnished with castor sacs: hence it will be convenient to consider them in the two sexes separately.

1. *Of the Male Castor Sacs.*—If the animal be placed on his back, we observe,

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[1] Juvenal, *Sat.* xii. v. 34.

[2] *Hist. Nat.* lib. xxxii. cap. xiii. ed. Valp.

[3] *Fauna Boreali-Americana.*

[4] See some remarks on the distinctions between the burrowing and building beavers, in *Jameson's Journal*, xxviii. 68.

near the tail, a hollow (called by some a *cloaca*) inclosed by a large wrinkled, somewhat hairy, cutaneous protuberance, which, according to Perrault,[1] is easily contracted and dilated, not only by a sphincter, as the anus, but simply like a slit. In this hollow the anus, the prepuce, and the oil sacs open.

When the skin of the abdomen is removed, four eminences, covered by their appropriate muscles, are brought into view. They are placed between the pubic arch and the so-called cloaca. The two nearest the pubes are the *castor sacs*, while those next the cloaca are the *oil sacs*. Between the two castor sacs, in the male, lies the *penis* with its bone (*os penis*); it is lodged in a long *preputial canal*, which terminates in the cloaca, and has some analogy to a vagina; so that there is some difficulty to determine until the skin be removed, whether the individual be male or female.

The penis points towards the tail, not towards the navel, as in the dog. Its surface is covered with longitudinal wrinkles and pits: in each of the latter is found a dark-coloured warty-like body. The *testicles*, *vasa deferentia*, and *vesiculæ seminales*, present nothing remarkable. There is no *scrotum*. Like most other Rodentia, the beaver has *vesiculæ accessoriæ*, or blind ducts, which open into the urethra near its commencement. Just at that point where the urethra joins the penis are observed *Cowper's glands*. The *castor sacs* open by a common aperture into the preputial canal. This aperture is about one inch in width, and is placed opposite the extremity of the *glans penis* in the relaxed condition of the organ, and about one inch from the orifice of the prepuce. Between this common orifice of the castor sacs and the glans penis is a semilunar fold. There is also a second, similar, but thicker, fold covering the rectum. The *castor sacs* are pyriform and compressed. They communicate with each other at their cervical portion; but their fundi diverge outwards and towards the pubes. Each castor sac is composed of an *external* or *cellular* coat which incloses *muscular fibres*. The latter are a continuation of the panniculus carnosus: their function appears to be to compress the sac. Within these fibres lies a very *vascular coat*, which covers the scaly or glandular coat, and sends processes in between the convolutions of the latter. The *scaly or glandular coat* forms numerous folds or convolutions, which are largest and most numerous in the fundus of the sac. Externally, it is shining, silvery, and iridescent. Internally, it presents numerous, small, lanceolate, oblong or semilunar scales, which are mostly toothed at their margin and envelope each a *brown body*, supposed to be a gland, and which is lodged in a small cavity. The inner surface of the castor sacs is lined with *epithelium* (a continuation of the epithelium of the prepuce), which invests the glands and scales of the scaly or glandular coat. In the cavity of the castor sac is found the *castoreum*, which, when recent, is thin, fluid, highly odorous, yellow or orange coloured, becoming deeper by exposure to the air. The quantity of this secretion is liable to great variation. The *oil sacs* are conglomerate glands, placed one on each side between the castor sac and anus: their ducts terminate in the cloaca. The secretion of these sacs is a fatty matter, having the consistence of syrup or honey, a peculiar odour, and a yellowish colour. It was formerly used in medicine under the name of *pinguedo* seu *axungia castoris*.[2]

2. *Of the Female Castor Sac.* — We are less perfectly acquainted with the anatomy of the female than of the male beaver. Indeed, I am acquainted with three dissections only of the former; viz. one by Gottwaldt, a second by Hegse,[3] and a third by Mortimer.[4] The subjoined description is from the memoir of the last-mentioned authority. He says the animal had two *ovaria*, and a *uterus* dividing into two horns (uterus bicornis) as in the bitch. The *bladder* lay exactly over the body of the uterus. The *meatus urinarius* ran upon the *vagina* above two inches in length. Just below the *os pubis*, on each side of the vagina, above the meatus urinarius (supposing the animal laid on her back), a pair of *pyriform bags* were found, about 1¾ inches long, and 1 inch broad, diverging at their fundi or broad ends, but approximating most closely at their necks on narrow extremities, which were canals communicating with the adjoining glands. The membranes which formed these bags were tough, wrinkled, and furrowed, of a livid dirty colour. They were hollow, and capable of containing about an ounce of water. Upon opening them a small quantity of dark brown liquor, like tar, was

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[1] *Mem. for a Natural History of Animals*, p. 85, Lond. 1701.

[2] For further details respecting the structure of the castor sacs, consult Brandt and Ratzeburg, *Med. Zool.* i.

[3] Both referred to by Ratzeburg, *op. supra cit.*

[4] *Philosophical Transactions*, xxxviii. 1735.

found, having an odour like castoreum, and in addition a smell of ammonia. It is probable that the emptiness of the sacs, and the unusual quality of their contents, arose from the youth of the animal. About an inch lower, on each side of the vagina, were a pair of *glands* (*oil sacs*), each about 1½ inches long, and ½ inch broad. Their form was oblong but irregular, and having several protuberances externally; their colour was pale flesh, like the pancreas. They seemed to communicate with the castor sacs, the sac and gland on each side opening externally by one common orifice, around which were long black hairs.

Hab.—North America, from 67° or 68° to about 33° north latitude; Europe, from 67° to 36° north latitude, but becoming very scarce. It appears to have been indigenous.

CAPTURE OF THE BEAVER.—The beavers are caught in various ways; sometimes in traps, sometimes in nets: but the usual method is to break up the beaver houses, when the animals retreat to their bank holes, where they are easily taken.

COMMERCE.—Castoreum is imported from North America by the Hudson's Bay Company. The greater part of that brought over is sold for exportation. In 1839, duty (6d. per lb.) was paid on 801 lbs.

DESCRIPTION.—Two kinds of castor (*castoreum*) have long been known, viz. Russian and American. The latter, however, is the only one now met with in English commerce.

1. **American Castor** (*Castoreum Americanum.*)—It usually consists of two isolated sacs, frequently wrinkled, and which are connected so as to form two parts, like a purse, or like two testicles connected by the spermatic cords. The size of the sacs is liable to considerable variation: they are elongated and pyriform. The penis or the oil sacs, or both, are sometimes attached to them. The colour and other external characters are variable. In December 1834, I examined between three and four thousand pounds of castoreum, which was offered for sale by the Hudson's Bay Company. A considerable quantity of it was covered externally with a bluish-white mouldiness, while the remainder was of a brownish colour. The brown colour, however, varies considerably; sometimes being dark, in some cases yellowish, or even reddish. Some castor sacs are found nearly empty, and present, in their dried state, a very fibrous character; these are of inferior quality. Others are found gorged with unctuous matter, and, when quite dry, break with a resinous character, presenting no fibres until they have been macerated in spirit of wine. In many well-filled sacs the castoreum is quite soft.

In English commerce, two varieties of American castoreum are made: one called the *Hudson's Bay*, the other the *Canadian*. Both are imported by the Hudson's Bay Company. The *Hudson's Bay castoreum* is usually considered the finest variety. The specimens of it which I have examined at the house of the Company, in December, 1834, came from Fort York and Moose River. The finest samples were superior to any of the Canadian kind, though the average quality was much the same.

2. **Russian Castor** (*Castoreum rossicum.*)—This is exceedingly scarce. When met with it fetches a very high price. I have paid for a museum sample £2 per oz., while American castor fetched only twenty shillings per lb. There are at least three kinds of castor sold as Russian. *Chalky Russian castor* occurs in smaller and more rounded sacs than the Ameri-

can kind.[1] The specimens of it which I have seen had neither penis nor oil sacs attached. The colour is ash-brown. Its odour is peculiar, empyreumatic, and readily distinguishable from that of the American kind. Under the teeth it breaks down like starch, has at first little taste, then becomes bitter and aromatic. It is readily distinguishable from all other kinds by dropping it into diluted hydrochloric acid, when it effervesces like a lump of marble. I have seen another kind of castor from Russia, which may be termed *Resinous Russian Castor.* The sacs were large, well filled with resin, did not effervesce with hydrochloric acid, and had an odour very similar to that of American castor. The *Russian castor described by Guibourt*[2] appears to have been subjected to some preparation.[3] [Among the frauds connected with the sale of castor, the author mentions that he examined a pair of "fictitious castor sacs," but found them to be real sacs emptied of their natural contents and stuffed with hay. The coats were thin and membranous.—Ed.]

Composition.—Castoreum has been subjected to chemical analysis by several chemists. Those whose results deserve especial reference are Bonn[4] and Brandes.[5]

Brandes' Analyses.

Volatile oil	1·00
Resin	13·85
Castorin	0·33
Albumen	0·05
Osmazome	0·20
Carbonate of lime	33·62
Other salts	2·82
Mucus	2·30
Animal matter like horn	2·30
Membrane	20·00
Moisture and loss	22·83
Canadian Castor	99·30

Volatile oil	2·0
Resin	58·6
Cholesterine	1·2
Castorin	2·5
Albumen	1·6
Gelatine	10·4
Osmazome	2·4
Matter soluble in alcohol	1·6
Carbonate of lime	2·6
Other salts	2·4
Membrane	2·0
Moisture and loss	11·7
Russian Castor	99·0

These analyses do not agree with my experiments and observations. The quantity of carbonate of lime assigned to Canadian castor is much too large. By incinerating 60 grains of American castor in a platinum crucible I found only 1·2 grs. of ashes, which, if the whole were lime, would be equal to little more than 3·57 per cent. of chalk.

1. Volatile Oil of Castoreum.—This is obtained by distilling the same water several times with fresh portions of castor. It is pale yellow, and has the odour of castor, with an acrid bitter taste. Bonn says he obtained 34 per cent. of oil, but there must be some error in this statement.

2. Castorine; *Castoreum Camphor*, Gmelin.—A crystalline, fatty, non-saponifiable substance. It is fusible, and in the liquid state floats on water. When pure it is quite white. It is soluble in ether and boiling alcohol. By long ebullition with nitric acid, it is converted into a yellow crystallisable acid, called *castoric acid.* The supercastorate of ammonia is crystallisable, and forms white precipitates with the salts of silver, lead, and protoxide of iron, and a green precipitate with the salts of copper. Castorine is obtained by boiling castor in alcohol; the castorine is deposited when the liquor cools. Scarcely any can be got from American castor.

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[1] See *London Medical Gazette*, xvii. 296, fig. 41.

[2] *Journ. de Chim. Med.* viii. 602.

[3] See *London Medical Gazette*, xvii. 297, fig. 42.

[4] Quoted by Gmelin, *Handb. d. Chem.* ii. 1449.

[5] *Ibid.*

3. RESIN.—This is dark brown, has an acrid and bitter taste, and a slight odour of castor. It is insoluble in pure ether, but dissolves readily in alcohol. Water precipitates it from its alcoholic solution.

[In reference to the chemical constitution of Castor, Dr. Pereira made the singular discovery that the aqua castorei contained the hydruret of salicyle. His paper on the subject was published in the Pharmaceutical Journal for November 1851.—ED.]

In the year 1844, Wöhler[1] remarked that Carbolic acid ($C^{12}H^{5}O^{1}HO$) strongly resembled in odour fresh castoreum, and suggested that the volatile oil of castoreum was probably nothing but carbolic acid; and added, that, like the latter substance, it became black by its reaction with chromic acid. Soon after this observation I endeavoured to verify it, by subjecting *aqua castorei*, freshly prepared from good American castoreum, and in which were floating globules of *oleum castorei*, to the action of a solution of chromic acid; but I failed to produce any blackening effect, even at a boiling temperature. It occurred to me, therefore, that probably carbolic acid was not an invariable constituent of castoreum. In 1848 Wöhler[2] announced the existence of both carbolic acid and salicine in Canadian castoreum. By subjecting this to distillation with water, he obtained a clear distillate in which small drops of oil were floating, and which possessed a strong odour of castoreum. With sesquichloride of iron, it gave distinctly, though feebly, the characteristic reaction of carbolic acid; it became violet, which colour again disappeared in a short time, with a whitish cloudiness precisely like carbolic acid. It was not coloured yellow by ammonia, as is the case with hydruret of salicyle (salicylous acid). In the liquid which was left in the retort, Wöhler detected, after filtration, a benzoate and salicine. On mixing it with muriatic acid, it became turbid, and, in the course of a day, deposited small crystals of benzoic acid. It was also observed that the mother-liquor separated from these crystals contained hydruret of salicyle, for it gave with sesquichloride of iron, first a deep violet blue colour, and only afterwards the white cloudiness produced by benzoic acid. In the muriatic solution, from which the benzoic acid had separated, Wöhler detected salicine by the action of chromate of potash and sulphuric acid, which converted it into hydruret of salicyle.

I had occasion to examine the *aqua castorei*, prepared from American castoreum, and was surprised to find that it had acquired the very agreeable odour of the distilled water of the flowers of meadow-sweet (*spiræa ulmaria*). It no longer contained any traces of volatile oil. On testing it with sesquichloride of iron it gave at first a violet colour, and afterwards a whitish cloud (*benzoate of iron*). With ammonia it became feebly yellow. It was obvious, therefore, that it contained hydruret of salicyle, which must either have been originally obtained by distillation from the castoreum, or have been produced in the *aqua castorei* by some other principle. That it was not originally obtained from the castoreum I have strong grounds for believing; because the *aqua castorei*, when first prepared, had not that agreeable odour which it now possesses, but had the usual castoreum smell, and contained abundance of globules of volatile oil of castoreum. For several years past, in my lectures, I have noticed and described it, and have remarked, that unlike another specimen of *aqua castorei*, which I prepared in 1833,[3] it appeared to me to be losing its proper castoreum odour, and to be acquiring a more agreeable one. During the last twelve months, however, the change of odour has been more marked and rapid than it had been previously, the hydruret of salicyle having been gradually formed in the *aqua castorei*. As the *aqua castorei*, in which it was formed, was obtained by distillation, it is obvious that the hydruret of salicyle must have been produced from some volatile substance. Now as the water originally contained globules of *oleum castorei*, which have gradually disappeared, and become replaced by the hydruret of salicyle, this oil would seem to be the real source of the last-mentioned substance. However this may be, it can scarcely be doubted that both the hydruret of salicyle and carbolic acid (which Wöhler declares to be identical with *oleum castorei*) are derived from salicine (the presence of which in castoreum has been before stated.) As the beaver feeds on the bark of the willow and poplar, we have a ready explanation of the source of the salicine.

Salicine by oxidation readily yields hydruret of salicyle (as by the action on it of a mixture of chromate of potash and sulphuric acid). When it is swallowed, it suffers oxidation, and is excreted, in the form of hydruret of salicyle. Professor Liebig informed me that *Chrysomela Populi*, a coleopterous insect which feeds on the leaves of the willow and poplar, excretes hydruret of salicyle; and if allowed to crawl over paper moistened with a persalt of iron it produces a violet-coloured stain. In the human subject, also, salicine suffers a similar change, and is converted into hydruret of salicyle, which passes out of the system in the urine, in which fluid it may be detected by a persalt of iron, which strikes a violet colour with it. Laveran and Millon assert that salicylic acid is also produced, but this is doubtful; for Wöhler and Frerichs found that hydruret of salicyle did not become changed into salicylic acid in its passage through the system. Hitherto, I believe that carbolic acid has not been detected in the urine after the use of salicine; but its presence is by no means improbable, as it is one of the products of the decomposition of the alkaline salicylates.

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[1] *Ann. d. Chem. u. Pharm.* B. xlix. S. 360, 1844; also *Pharm. Journ.* iv. 186, 1844.

[2] *Ann. d. Chem. u. Pharm.* B. lxvii. S. 360, 1848; also *Chemical Gazette*, vii. 11, 1849.

[3] This specimen also contains minute traces of the hydruret of salicyle, as shown by the action of the sesquichloride of iron, as well as of ammonia.

But to return to the origin of the hydruret of salicyle in *aqua castorei*. It by no means follows that it should be derived from the carbolic acid, but more probably from some other volatile product of the oxidation of salicine. As carbolic acid is a constituent of castoreum, and as it is a powerful agent on the animal economy, it follows that it must be one of the active principles of castoreum. Wöhler and Frerichs found that rabbits, guinea-pigs, and dogs, to which a few drops of carbolic acid diluted with water were administered, constantly died in convulsions in the course of one quarter of an hour; but no important anatomical lesion was discovered in the bodies after death. As castoreum contains but a very minute quantity of carbolic acid, it is obvious that should its medicinal activity be found to depend on the latter, a cheap and more effective substitute for castoreum would be found in carbolic acid obtained from coal tar. And here I may observe, that carbolic acid and creasote are closely related, if indeed they be not identical, as Laurent and some other chemists suspect.

As the odour of *Hyraceum* (see p. 829.) closely resembles that of castoreum, the presence of carbolic acid may be suspected, but no evidence of its presence can be gained by the action of the sesquichloride of iron on either a watery infusion of hyraceum, or on the distilled water of this substance.

Physiological Effects. — Castor is usually denominated a stimulant and antispasmodic. Since the time of Hippocrates it has been regarded as endowed with a specific influence over the uterus. In 1768, Mr. Alexander[1] took it in various doses to the extent of two drachms; and the only effect he experienced from it was disagreeable eructations. In 1824, Jörg and his pupils, males and females,[2] submitted themselves to its influence; but the only effects were a slight uneasiness in the epigastric region, and disagreeable eructations having the odour of castor, and which were not allayed by breakfast or dinner, and only ceased at night when sleep came on. These facts seem to show that castoreum possesses but little medicinal power: yet Dr. Cullen[3] declares that on many occasions it is certainly a very powerful antispasmodic. Its odorous particles become absorbed, for they have been recognised in the urine by their smell.

Uses. — Castoreum was formerly in great repute in those affections of the nervous system denominated *spasmodic*, such as hysteria, epilepsy, and catalepsy, more especially when these diseases occurred in females, and were attended with uterine disorder. In those kinds of fever called *nervous*, this medicine has also been recommended. In the northern parts of Europe it is used for its supposed *uterine influence*, to promote the lochial discharge, and the expulsion of retained placentæ. It is, however, little employed, partly, perhaps, in consequence of its disagreeable taste and smell, its variable quality, and its high price; but, for the most part, I believe, because practitioners consider it an almost inert remedy.

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[1] *Experimental Essays*, p. 83.

[2] *Material. zu einer kunft. Arzneimittell.* Leipsig, 1824; *London Medical Gazette*, xxvi. 952.

[3] *Mat. Med.*

ADMINISTRATION.—It is best given in substance, either reduced to powder or in the form of pill. The dose should be at least ʒij.

1. **TINCTURA CASTOREI**, L. E.; *Tincture of Castor.* (Castor, bruised, ℥iiss.; Rectified Spirit, Oij. Macerate for seven days, then press and strain. "This tincture may be prepared either by digestion or percolation, like the tincture of Cassia," *E.*)—Rectified spirit, used by the London and Edinburgh Colleges, is a better solvent for castor than proof spirit. The quantity of castor used in the processes is much too small. A fluidounce of the Edinburgh tincture contains three-fourths of a drachm, while the London preparation contains only half a drachm; so that to give a medium dose of castor (ʒj.), it would be necessary to administer f℥ij. of the tincture (rectified spirit) of the London Pharmacopœia! Dr. Paris[1] says the dose of this tincture is ♏xx. to fʒij. The tincture of castor made with American castor has a very different odour, is of a much paler colour, and yields a much smaller amount of precipitate on the addition of water, than the tincture of Russian castor.

2. **TINCTURA CASTOREI AMMONIATA**, E.; *Ammoniated Tincture of Castor.* (Castor, bruised, ℥iiss.; Assafœtida, in small fragments, ʒx.; Spirit of Ammonia, Oij. Digest for seven days in a well-closed vessel; strain and express strongly the residuum; and filter the liquor. This tincture cannot be so conveniently prepared by the method of percolation, *E.*)—Stimulant and antispasmodic. Spirit of Ammonia is a good solvent for both castor and assafœtida.—Dose, fʒss. to fʒij.

388. Hyrax Capensis.—The Cape Badger.

(Hyraceum, a proposed substitute for Castoreum.[2])

HISTORY.—I have received from my friends, Messrs. August Faber and Co., of London, a small sample of this substance, with a note, stating that Hyraceum was a new article, intended as a substitute for castoreum in medicine. They inform me that they believe all that has been imported into Europe as yet, is a dozen tins of about one pound and a half each, which were sent from the Cape of Good Hope (the place of production) to Hamburgh, and there sold at about eight shillings each. The tins were of a cylindrical shape, and the hyraceum contained in each was in one mass, adhering to the tin without any other protection. As this substance is a very remarkable one, and is scarcely known even by name in this country, I subjoin a short notice of it, and of the animal which yields it.

The name *hyraceum* was first applied to this substance by Dr. Edward Martiny,[3] in 1847. It is derived from *Hyrax*[4] (the generic name of the animal yielding this substance), and bears the same relation to this latter word that castoreum does to castor. By the Dutch colonists, this substance has been erroneously called *Dassen-piss*, under the mistaken notion that it was the urine of the *Dasse* (the name by which the animal is known at the Cape).

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[1] *Pharmacologia.*

[2] From a paper by the author in the *Pharmaceutical Journal*, September 1850.

[3] *Naturgeschichte der für die Heilkunde wichtigen Thiere*, p. 119.

[4] The word "hyrax" is derived from ὕραξ, which Nicander (*Alexipharmaca*, 37) uses to signify the shrew-mouse.

Zoology. — The animals referred by zoologists to the genus *Hyrax*, and called by French zoologists *Damans*, possess remarkable interest to the naturalist, on account of the importance of anatomy to the accurate determination of their position in a natural classification. For a long period they were placed among the *Rodentia*, to which in size and general appearance they bear some resemblance. But Cuvier showed that by their organisation, they really belong to the *Pachydermata*, being, with the exception of the horn, little else than rhinoceroses in miniature; at least, they have quite similar molars, but the upper jaw has two stout incisors, curved downwards, and, during youth, two very small canines, the inferior four incisors, without any canines. The dental formula of the genus, therefore is as follows: — incisors 0, canines $\frac{2}{4}$, molars $\frac{7}{7}$—$\frac{7}{7}$ =34. The animals have four toes to each of their fore-feet, and three to the hind-feet, all, excepting the innermost posterior, which is armed with a crooked and oblique nail, terminated by a kind of very small, thin, and rounded hoof. The body is covered with thick hair, and beset here and there with crinaceous bristles. They have a simple tubercle in place of a tail, short muzzle and ears, and six teats, two pectoral and four ventral.

The *Hyrax capensis*, Cuvier, the *Cavia capensis* of Pallas, and some other writers, was considered by Cuvier to be identical with the *Hyrax Syriacus* — the *Coney* of Scripture.[1] It is about the size of a large rabbit; with soft hairs, greyish or ashy-brown above and paler beneath. Along the back is a dark band or stripe, with a blackish-spot in the middle. The head is thicker, and the mandible or lower jaw higher than in other species. Vertebræ from forty-eight to fifty. Ribs twenty-one to twenty-two. Space between the incisor and molar teeth small. Interparietal bone large and three angled.

Thunberg[2] alludes to the popular notion at the Cape that these animals menstruate. "In the crevices of the mountains, a great number of *dasses* (*Cavia capensis*) were found, which were generally supposed to have the menstrual flux." In another passage[3] he says, he "was shown a kind of bitumen, which the country people supposed to be the inspissated urine of the great mountain rat (*Cavia capensis*) that is found there. I was informed," he adds, "that this bitumen was to be found in great abundance in the cracks and crevices of the mountain, especially at one large projecting *krants* or summit." Sparman[4] notices the animal which the native call *dasses* or *badgers*. "These creatures," he observes, "which have some affinity with the ordinary marmots, and are about the same size, are eaten by many people, who look on them as a delicacy. They are likewise easily made tame, and are found in many other places in the African mountains. The little *Dassen islands* on the western coast of Africa take their name from them. On these places in the mountains where these creatures dwell, there is found a substance, called here, *dassen-piss*. It resembles petroleum, or rock oil, and by many that have seen it is actually considered as such. It is likewise used by some people for medicinal purposes, and by them is supposed to have greater powers than is consistent with any degree of probability. Finding that this substance did not stand the same proofs as petroleum, and at the same time that it was found only in places frequented by the *dasses*, I had sufficient reason to conclude that it proceeded from this animal, and that it is most probably the menstrual excretion of this creature, as observations made on tame females of this species have given room for such a suspicion; and as besides the dass's excrements are often found in this substance, and seldom anywhere else." Professor Lichtenstein informed Schrader that "this substance is found in small separate pieces on rugged mountainous declivities, chiefly in those districts where the *Hyrax capensis* is most frequently found. The colonists collect these pieces, which, when fresh, are soft and somewhat glutinous, and press them together in large masses, in which state the volatile constituents are better preserved. They employ it medicinally, either in the form of powder, or infused in wine, in many diseases, especially in hysterical complaints, in which it frequently acts in a surprisingly beneficial manner."

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[1] *Leviticus*, xi. 5; *Psalms*, ciii. 18.

[2] *Travels in Europe, Asia, and Africa, between the years* 1770 *and* 1779, i. 165.

[3] *Ibid.* i. 166.

[4] *Voyage to the Cape of Good Hope*, i. 309, 1786.

"The Hottentots," says Buffon,[1] "highly prize a kind of medicine, which the Dutch call *badger's urine* (*pissat de blaireau*). It is a black dry substance, which has a very bad smell, and is found in the crevices of the rocks, and in caverns. They say it is derived from the urine of these animals, who always pass it in the same spot. The urine deposits this substance, which, becoming dry by time, acquires some consistency. This," adds Buffon, "is very probable; for the animal at Amsterdam almost always passed his water in the same corner of the cage in which he was confined."

In the published accounts of the dissections of this animal, no glandular structure, such as we must suppose would be required for the secretion of hyraceum, is mentioned. Mr. Quekett, having examined a portion of the specimen which I gave him, believed it "to be composed entirely of excrement, and not, like castoreum and musk, the secretion of a gland; for I find," he adds, "that the hyrax capensis has no anal or other glands."[2] But it deserves to be especially noticed that dissections of *male* animals only have been published: while the remark of Sparrman would lead us to suspect that the secretion is peculiar to the female. Further observations respecting the anatomical structure of the animal are required ere we can arrive at any satisfactory conclusion respecting the origin of hyraceum. My friend, Mr. Thomas Bell, who some years since had in his possession a living full-grown male animal (the one which was subsequently dissected by Professor Owen), informed me that his specimen had no peculiar smell, nor did he perceive any peculiar gland on examination after death.

Pallas[3] notices as unusual and anomalous in the structure of the animal, the mode of insertion of the ureters into the fundus of the bladder. Professor Owen notices, and somewhat corrects this description.[4] For what purpose this structure is designed in the hyrax, or whether the urine undergoes any change in consequence of it, Mr. Owen could not conjecture, but he alluded to the alleged medicinal qualities of this secretion.

Dr. Krauss, of Stuttgart, who resided for a long time at the Cape, says, that most of the colonists regard it as a secretion which appears with the catamenia. Dr. Edward Martiny,[5] who reports this, adds, "that its occurrence at the rutting season gives great weight to this opinion. I regard hyraceum," he continues, "as a secretion connected with the sexual functions, and produced by highly developed preputial and probably also vaginal glands, as in the beaver, but with this difference, that while in the beaver we know not whether this secretion is at times evacuated, in the hyrax it is very probably actually excreted. For we find it in considerable quantities in those places where the animals are met with; a fact explained by the circumstances that the animals at the Cape usually live in herds. Dr. Krauss writes to me, that it is especially found in the fissures of the variegated sandstone of many mountains in the colony, especially in Kokmansklof and Franche Hoek, and may be collected there in extraordinary quantity. In proof of this, it may be mentioned, that some years ago, Professor Pöppig, of Leipsig, received from the Cape some bird-skins, stuffed with hyraceum to preserve them. So that it must be met with in considerable quantity, and at a low price, and might, therefore, be obtained as an excellent substitute for the more costly castoreum."

PROPERTIES.—*Hyraceum*, such as I have received it, is a tolerably hard solid substance, which breaks with considerable difficulty; and has a blackish brown colour, a glistening or resinous appearance in places, which have a somewhat glutinous feel. It has a moderately strong odour, which greatly resembles that of Canadian castoreum. In taste, also, it is like the latter substance. [Its specific gravity is from 1·422 to 1·5.] When heated in the flame of a candle, it evolves a castor-like odour, swells up, burns, and leaves behind it a spongy coal, with a whitish ash on the apex. From the yellow colour which it communicates to the outer cone of the flame, it manifestly contains sodium or soda, and from the intense white light which the ash on the apex of the coat evolves, it obviously contains lime (?). Water dissolves a considerable portion of it. Boiled in alcohol, it communicates a feeble colour to this liquid. By boiling in water, it evolved a smell similar to that of castoreum, and yielded a decoction which was of a dark yellowish-brown colour, and very feebly restored the blue colour of reddened litmus paper. When submitted to dry distillation in a test tube, it evolved, first, an odour of castoreum, then a dense white empyreumatic smoke, which communicated a blue colour to reddened litmus paper, thereby indicating the presence of ammonia. Hyraceum has been submitted to a careful microscopic examination by myself as well as by my friends Dr. Sharpey and Mr. John Quekett. Vegetable tissues (epidermis, cellular tissue, woody fibre, ducts and spiral vessels), animal hairs, and siliceous sand, have been found in it. Mr. John Quekett observes that "spirit and caustic potash appear to have little or no action on it; but they bring out a few epithelium scales, principally of the scaly variety." I could detect no blood discs. Dr. Sharpey also observes that he "saw nothing which could for a moment be taken for blood particles or the remnants of blood particles." He observed globular particles, perhaps, either resinous or oily; and at least two kinds of vegetable epidermis, one apparently from a gramineous plant. The animal hairs were short fragments, very fine, and by no means numerous.

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[1] *Histoire Naturelle*, Supplement, t. vi. p. 280, 1782

[2] [Mr. Quekett could detect no trace of any glands likely to produce the hyraceum.—ED.]

[3] *Spicilegia Zoologica*, t. i. fasc. ii. p. 16, 1767.

[4] *Proceedings of the Zoological Society*, 1832.

[5] *Op. ante cit.*

As the hyraceum which I have received contains vegetable remains, and probably, therefore, is contaminated with the excrement of the animal, I was anxious to know what kind of fæcal matter is discharged from the bowels. Pallas says that the "scybala in ultimo intestino erant moleculosa, fusco-lutea." Dr. Andrew Smith, author of the *Illustrations of the Zoology of South Africa*, tells me that the fæces are in little balls, something like rabbits' dung. He also informs me that in the places where the animals live at the Cape, the fæces occur in heaps, while the hyraceum is found in the crevices of the rock, as if it had run off in a liquid state, from which he inferred that it was a product of urine and excrement.

Composition.—Schrader[1] submitted hyraceum to chemical examination, and found its constituents to be as follows:—

Stearine (*Talgsubstanz*)	1
Green resin, soluble in absolute alcohol	2
Odorous yellow substance, soluble in ordinary alcohol and in water	38
Brown substance, soluble in water	25
Insoluble residue (vegetable fibre, quartz sand, &c.)	34
	100

From his experiments, Schrader concluded that hyraceum was for the most part of an animal nature, very probably an excretion, and that its medicinal properties resided in its odorous yellow constituent, which dissolved both in spirit and in water. Its colour did not arise from the presence of blood, for he left a decoction of hyraceum exposed to the air for some weeks, without finding that it underwent putrefaction or any change of odour. It still retained the smell of Canadian castoreum, and had scarcely any effect on reddened litmus paper. By distillation with water, a distilled liquor was obtained, which had a feeble, faint, somewhat resinous odour, but no reaction on test paper. The minute quantity of urine therefore, which it contained, must be regarded, like the sand and the vegetable substances, as an accidental impurity, although it is not impossible that these substances may be due to the admixture of animal excrement. According to Paffe, it is produced by the uropoietical system. The hyrax drinks very seldom, if ever; and its urine, like that of the hare, is thick and glutinous. The animals void their urine at one spot, and by evaporation the tenacious extract sticks to the root. The fresh urine is reddish-coloured. Lehmann regards it as solid excrement. Reichel[2] analysed hyraceum, and obtained twenty different substances, including castorin, uric acid, urea, as well as benzoic and hippuric acids: but Fikentscher says that he could not detect either of the last four substances; and he gives the following vague statement as the results of his analysis:—

Matter soluble in ether	11·5
Matter soluble in spirit of wine	38·0
Matter insoluble in both	19·1
Inorganic salts	31·4
Hyraceum	100·0

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[1] *Berlin. Jahrb. für d. Pharmacie*, 1818.

[2] *Pharm. Central Blatt fur*, 1849.

USES.—With regard to the medicinal qualities of hyraceum I have very little to say. I believe it to be inert and useless; but it has been supposed to resemble castor in its nature, odour, and medicinal qualities. "The action of hyraceum," says Dr. Martiny, "is exactly the same as that of American castor, for which it may be substituted." But to say that hyraceum is equal to castor in medicinal properties is, I believe, to say little in its favour; for, in my opinion, there is no valid evidence that castor possesses any medicinal power whatever. Considered in an anatomical and physiological point of view, both castor and hyraceum possess some interest, but as therapeutical agents they are worthless. The remedial use of sexual and anal secretions and of excrements (*e. g.* castor, civet, ambergris, album græcum, and hyraceum) belongs to the superstitious and absurd practices of a former age, and the administration of such disgusting and useless substances should be banished from scientific medicine. Hyraceum has been used in the form of powder, or of tincture.

TINCTURA HYRACEI (Martii).—℞ Hyraceum, powdered, ℥iij.; Distilled Water, ℥xviij. Digest at from 86° F. to 100° for eight days, frequently shaking. Filter, and to the solution add: Water, sufficient to make by weight, ℥xxj.; Rectified Spirit, ℥iij. Mix and filter. Dose ♏xx. to fʒj.

[Experience has not confirmed the favourable description of the new drug as given by Fikentscher in his inaugural dissertation at Erlangen. We are inclined to put the same value on it as that assigned by the author to album græcum, and other excrementitious articles. They are the relics of the superstitious practices of a bygone age.—ED.]

TABULAR VIEW

OF THE

HISTORY AND LITERATURE

OF THE

MATERIA MEDICA.

I. WORKS ON THE HISTORY OF MEDICINE GENERALLY.

Dr. D. Le Clerc. *Histoire de la Médecine.* Gen. 1696. 4to ; à la Haye, 1729. (Brought down to the time of Galen. An Engl. transl. by Drs. Drake and Baden. 8vo. Lond. 1699.)

Dr. J. Friend. *The History of Physick from the time of Galen to the beginning of the Sixteenth Century.* 2 vols. 8vo. Lond. 3rd ed. 1727.

Dr. J. H. Schulze. *Historia Medicinæ a rerum initio ad annum urbis Romæ* DXXXV. *deducta.* Lips. 4to. 1728.

Dr. J. C. G. Ackermann. *Institutiones Historiæ Medicinæ.* 8vo. Norimb. 1792.

Kurt Sprengel. *Histoire de la Médecine depuis son origine jusqu'au dix-neuvième siècle.* Trad. de l'Allemand par A. J. L. Jourdan. Paris. 9 vols. 8vo. 1815—20.

Dr. D. L. Choulant. *Tafeln zur Geschichte der Medizin.* Leipzig. 1822. fol.

E. Morwitz. *Geschichte der Medicin.* 2 vols small 8vo. Leipzig. 1848—9.

Wm. Hamilton. *The History of Medicine, Surgery, and Anatomy, from the Creation of the World to the commencement of the Nineteenth Century.* 2 vols. small 8vo. Lond. 1831.

Dr. J. Bostock. *History of Medicine,* in the *Cyclopæd. of Pract. Med.* Vol. I.

Dr. C. Broussais. *Atlas Historique et Bibliographique de la Médecine, ou Histoire de la Médecine.* Paris. 1834. fol. (A translation of Choulant's Tables, with additions to some of them.)

J. F. K. Hecker. *Geschichte der Heilkunde.* 2 vols. 8vo. Berlin. 1822—1829.

II. WORKS CONTAINING A SPECIAL HISTORY OF PHARMACOLOGY.

Dr. Wm. Cullen. *Treatise of the Materia Medica.* 2 vols. 4to. 1789.

Dr. F. G. Voigtel. *Vollständiges System der Arzneimittellehre.* 2 vols. 8vo. 1816—17.

Choulant. Op. supra cit.

Dr. C. H. E. Bischoff. *Die Lehre von den chemischen Heilmitteln oder Handbuch der Arzneimittellehre.* 3 vols. 8vo. Bonn. 1825—31.

Dr. C. Broussais. Op. supra cit. (Choulant's Table in French, without additions.)

EGYPTIAN MEDICINE.

Thout or Thaut (also called Hermes or Mercury), regarded as the founder of Medicine.

Medicine practised first by priests, afterwards by physicians who confined themselves to the study of one disease. (Herod. *Euterpe* LXXXIV.)

The sick exposed in public places (*Strabo*).

Purges, vomits, and clysters, used for three days successively in every month. (Ibid. LXXVII.) Dietetical regulations: the hog regarded as unclean. Baths and unguents.

B.C.

Worshipped a bulbous plant (Κρόμμυον; *Squilla?*), to which they erected a temple (Pauw).

Employed *aëtites*, slime of the Nile, frictions with crocodiles' fat in rheumatism, and mucilage of *semina psyllii.* Salt, νίτρον (carbonate of soda?), alum, plasters, and unguents; white lead and verdigris occasionally entered into the latter.

Fumigations with *Cyphi* (Κῦφι), a mixture of various drugs. (Dioscorides, i. 24.)

1729 Spices, balm, and myrrh, carried to Egypt. (*Gen.* xxxvii. 25.)

1689 Embalming practised. Palm wine, aromatics, myrrh, cassia, and other odorous substances (not frankincense), as well as νίτρον (carb. soda?) and gum used in this process.

⁂ Consult,—M. De Pauw, "Phil. Disert. on the Egyptians and Chinese." Vol. i. p. 130. 1795.
Prosper Alpinus, "De Medic. Ægypt."

HEBREW MEDICINE.

B. C.

The infliction and cure of diseases on various occasions ascribed by the Sacred Historian to the direct interposition of God. (*Exod.* ix. 15. *Numb.* xii. 10.)

Remedial agents consisted principally in strict hygienic means. (Circumcision, dietetical rules, separation, ablution, combustion of infected garments. See *Gen.* xvii. 10. *Lev.* xi. and xiii. 2 *Kings*, v.)

1491 Medicine practised by the Priests. (*Lev.* xiv.) Gold, silver, lead, tin, iron, and brass (copper?) mentioned by Moses.

1491 Odoriferous ointment and confection; the most ancient recipes on record. (*Exod.* xxx. 23—25, and 34, 35.)

1063 Music employed as a remedy. (*Sam.* xvi. 16.)

884 Sesquisulphuret of antimony (?) used as a face paint. (2 *Kings* ix. 30.)

713 Fig poultice. (2 *Kings* xx. 7.)

600 Physicians (not priests) referred to. (*Jerem.* viii. 22.) N.B. The so-called Egyptian physicians (*Gen.* l. 2) were probably ἐνταφιασταί, undertakers or embalmers.

The following substances are referred to in the Bible: the olive, saffron, barley, wheat, the fig, the vine, myrrh, bdellium, galbanum, cumin, coriander, flax, garlic, balm of Gilead, olibanum (frankincense), cassia, cinnamon, the almond, the pomegranate, dill (in our translation incorrectly called anise), colocynth? ricinus?

A. D.

40 Herod was let down into a bath of oil. (Josephus, *Bell. Jud.*, lib. i. cap. 33, § 5.)

Oil and wine applied to wounds. (*Luke* x. 34.)

Various superstitious practices. (Adam Clarke, *Comm.*, Note to *Mark* v. 26.)

⁂ For further information respecting Hebrew medicine, consult "the Bible;" J. H. Horne's "Introd. to the Crit. Study and Knowl. of the Holy Script.," vol. iii. 8th ed. 1839; K. Sprengel, "Analecta Historica ad Medicinam Ebræorum," Hal. 1796; De Carcassone, "Essai Historique sur la Méd. des Hébreux, anciens et modernes," 8vo. Montp. 1815; L. Choulant's "Bibliotheca Medico-Historica," 8vo. Lips. 1852.

ASSYRIANS.

The Babylonians had no professors of medicine. They exposed their sick in public places, in order that passengers might communicate their experience as to the best mode of cure. (Herodotus, *Clio* cxcvii.) Extracted oil from the Sesamum. (Ibid. cxviii.)

⁂ Consult,—D. G. Smoll, "Venerandæ antiquitas Assyriorum Chaldæorum, &c. Philosoph. Med. Regum et Princip. Philosophica et Med. Principia." 4to. Lubec. 1609.

A.D.

CHINESE MEDICINE.

229 Of its ancient state but little is known. The Chinese pretend that its study was coeval with the foundation of their empire, and that their medical code was the production of Hoangti, B.C. 2000 (Grosier). Before the Christian era there was a constant communication between China and India. (*Asiat. Journ.*, July, 1836.)

Medical science commenced with Chang-ka; for all works before that (said to be dated B.C. 1105 and 189) treat of medicine without giving prescriptions. (*Trans. of Med. Soc. of Calc.* i. 146.) As the Chinese have retained their ancient manners and customs, we must judge of what their medicine was by what it is.

Pun-tsaou (or *Herbal*), the most considerable Chinese work on Materia Medica, includes minerals, vegetables, and animals. (Davies, ii. 278.)

Ching che chun ching (*Approved marked line of Medical Practice*), a celebrated work, in 40 vols.; of which eight are devoted to *Luy-fang* (*Pharmacology*). The articles of the Materia Medica are very numerous. Ginseng is their panacea. Aromatics and gums in apoplectic cases. Opium as an anodyne and in dysentery. Mercury both raw and oxidized. Musk, rhubarb, tea, camphor of the Dryobalanops, assafœtida, spices, larvæ of the silk-worm, bones of tigers and elephants, vegetable wax, horns, fins, &c. Moxa. Croton Tiglium.

⁂ Consult,—J. B. De Halde, "Descript. Géogr. et Hist. de la China," t. iii. p. 318. 1770; L'Abbe Grosier, "Descript. Gén. de la China," t. ii. p. 466 1787; J. F. Davies, "The Chinese," vol. ii. p. 278; Gutzlaff, "Journ. of the Asiat. Soc.," vol. iv. p. 154; Choulant, *op. cit.* p. 69.

HINDOO MEDICINE.

1. *Ancient Medical Authorities and their Works.*

Brahma the Hindoo Deity; author of the *Vedas*, the most ancient books of the Hindoos, and next in antiquity to those of Moses. (Sir W. Jones, *Disc.* ix.)

Ayur Veda, the oldest medical writing of the Hindoos, forms a part of the 4th or *Atharva Veda* (the least ancient Veda). It is distributed into eight subdivisions. (See H. H. Wilson, *Calcutta Orient. Mag.*, Feb. and March, 1823; and Royle, *Essay*, p. 57.)

Dachsa, the *Prajapati*, to whom Brahma communicated the Ayur Veda, instructed the two Aswins or Sons of Surya (the Surgical attendants of the gods).

According to some the Aswins instructed Indra, the preceptor of Dhanwantari (also styled *Kasiraja*, prince of Benares); but others make Atreya, Bharadwaja, and Charaka, prior to the latter.

Date uncertain. Cannot be later than the ninth or tenth century, A.D., and probably much more ancient.

Charaka (*Sarac, Scarac, Scirak* or *Xarac*) mentioned by Serapion, Avicenna, and Rhazes. His work is extant, but not translated.

Susruta, son of Viswamitra, was pupil of Dhanwantari and contemporary of Rama. Treats chiefly of *Salya* and *Salekya* or Surgery, and divides medicines into locomotive (animals both viviparous and oviparous, and produced in moist places) and non-locomotive (plants and minerals). Gold, silver, arsenic, mercury, diamonds, earths, and pearls, are enumerated; also heat and cold, light and darkness, the increase and decrease of the moon's age, as remedial means. Lithotomy, the extraction of the fœtus, venesection. 127 weapons and instruments. Actual cautery. Alkaline caustics. Heated metallic plates. Leeches. Gourds used as cupping glasses. Astringent and emollient applications. Leaves, pledgets, threads, and bandages. Drastic and mild purgatives, emetics, diaphoretics, baths, and aspersions of water, stimulants, sedatives, narcotics, and acrid poisons, all employed. Datura, nux vomica, croton tiglium, myrobalans, &c. were adopted by the Arabs.

⁂ The Susruta; or System of Med. taught by Dhanwantari and composed by his disciple Susruta. Vol. i. 8vo. Calc, 1835.

2. *Early Translations from Hindoo Works.*

α. *Tamul*, by Maha Rishi Aghastier, who is named in the *Ramayana*, the oldest Hindoo profane work, and which is supposed to have been revised by the poet Calidas in the reign of Vikramaditya, whose era commences B.C. 57. (For a classification of drugs in a Tamul work called the *Kalpastanum*, see Royle's *Essay*, p. 54.)

β. *Cingalese.* (See a list in Ainslie's *Mat. Ind.* vol. ii. p. 525; also Heyne's *Tracts on India*, p. 125—171.)

γ. *Tibetan* made in the eighth century. (See Csoma de Körös, in *Journ. Asiatic Soc.* iv. 1.) 715 substances are mentioned, most of which are indigenous in India.

3. *Antiquity of Hindoo Medicine.*

Cannot be determined by Hindoo chronology or authors: hence must be ascertained from other sources. The great antiquity of Hindoo medicine is proved by the following circumstances:—

α. *Indian products are mentioned in the Bible.* (Royle, p. 138.) In early times commerce was established between India and Persia, Syria and Babylon; also by the Persian and Arabian Gulfs with Egypt, &c.

β. *At a very early period India was peopled and in a high state of civilization.* (For proofs, see Royle, p. 150—179.) As many chemical arts (*e. g.* distillation, bleaching, dyeing, calico-printing, tanning, soap and glass-making, manufacture of sugar and indigo) were practised by the Hindoos, who were acquainted with, and their country contains, all the chemical substances mentioned by Geber, it is not improbable that they and not the Arabs originated chemistry. The Grecian sages travelled in the East: hence the coincidences between the systems and discoveries of the Greeks and those recorded in Sanscrit works.

γ. *Indian products are mentioned by the Greeks and Romans* (*e. g.* by Hippocrates, Theophrastus, Dioscorides, Pliny, Oribasius, Ætius, and Paulus). They were doubtless employed in the countries where they were indigenous before they were exported.

δ. *Ancient inscriptions show the antiquity of Hindoo medicine.* A medical edict by King Piyadasi, directing the establishment of depôts of medicines and the planting of medicinal roots and herbs throughout his dominions and in the countries where Antiochus and his generals command. This, therefore, must have been issued and cut in rocks and metal pillars as early as B.C. 220.

ε. *The Persians translated Hindoo works* A.D. 531 to 572. (Royle's *Essay* p. 68.)

θ. *Hindoo physicians were in high repute at the court of Harum al-Rashid and Al-Mamoon, from* A.D. 786 to 850.

η. *The Arabian authors* (Rhazes, Serapion, Mesue, and Avicenna) *mention Charak, and quote from the Susruta.*

⁂ Consult,—H. H. Wilson, "Orient. Mag." Calc. 1823; and "Trans. Med. and Phys. Soc." Calc. vol. i.; B. Heyne, "Tracts on India," Lond. 1814; W. Ainslie, "Mat. Ind." 2nd vol. Lond. 1826; F. R. Dietz, "Analecta Med." Lips. 1834; J. F. Royle, "Essay on the Antiq. of Hindoo Med." 1837; Geldemeister, "Scriptorum Arabum de rebus indicis loci et opuscula inedita." 8vo. Bonn. 1838. Choulant, *op. cit.* p. 69.

GREEK MEDICINE.

B.C.

1. *Before the time of Hippocrates.*

1398 Melampus, a soothsayer and physician. Cured impotence by iron wine (Apollod. *Bibl.* Fr. transl. lib. i. cap. ix. p. 75); and madness by hellebore (Pliny, xxv. 21).

B.C.

1270 Chiron *the Centaur*, a physician and surgeon. Was cured of a wound by the *Centaurea Centaurium* (Ibid. xxv. 30).

1263 Æsculapius or Asclepias, renowned for his medical and surgical skill. His sons Machaon and Podilirius also famous surgeons; the latter practised venesection.

1134 The first temple to Æsculapius founded.

Asclepiadeæ, descendants of Æsculapius and priests of his temples. Votive tablets suspended in the temples

968 Euryphon author of the Γνῶμαι Κνίδιαι or Cnidian Sentences.
907 Homer mentions the Papaver somniferum, *νηπενθές* (*Cannabis indica?*
884 opium?), Moly (?), &c.

617 Aristæus discovered Silphium.

580—500 Pythagoras employed magic, dietetics, mustard, anise, and vinegar of squills (Pliny, xix. 30).

2. *Hippocrates.*

460—360? Hippocrates, the "*Father of Medicine.*" Born at Cos. The 18th by his father from Æsculapius. Ascribes diseases to alterations of the humours (blood, pituita or phlegm, and yellow and black bile). An antipathic. Employed diet, baths, exercise, bloodletting (venesection, cupping, and scarification), the actual cautery, the knife, and a very extensive series of medicines. His Materia Medica includes:—

1st. *Minerals*,—sulphur, lime, carbonate of soda, alum, common salt, oxide and carbonate of lead, acetate (and sulphate?) of copper, oxide of iron, and yellow and red sulphuret of arsenicum.

2ndly. *Vegetables*,—acacia, allium, ammoniacum, anethum, anisum, cardamomum, cassia, cinnamon, colocynth, conium, coriandrum, crocus, cuminum, cydonia, elaterium (?), euphorbia, fœniculum, galbanum, gallæ, glycyrrhiza, gnidium, helleborus, hyoscyamus, juniper, lactuca, laurus, linum, malva, marrubium, mastic, mentha, morus, myrrha, olea, opium, opobalsamum, opoponax, origanum, piper, pix, pulegium, punica, quercus, rosa, rubia, rumex, ruta, sambucus, sagapenum, scammonia, scilla, silphium, sinapis, staphisagria, styrax, turpentine, and veratrum.

3rdly. *Animals*, — Κανθαρίς (Mylabris Füsselini?), castoreum, sepia, ova, cornua, mel, serum lactis, and cera.

⁂ Dr. J. H. Dierbach. "Die Arzneimittel des Hippokrates." Heidelb. 1824.

3. *From Hippocrates to Galen.*

380 ANCIENT DOGMATIC (*or Hippocratean*) SCHOOL (*Theory in Medicine*)
380. Founded by Thessalus and Draco (sons of Hippocrates), in con-
354 junction with Polybius (their brother-in-law).—354. Diocles Carystius
(called the second Hippocrates), wrote on plants and dietetics. Gave a
341 leaden bullet in ileus.—341. Braxagoras *of Cos* (the last of the Ascle-
336 piadeæ); vegetable medicines.—336. Chrysippus *of Cnidus*, opposed
bleeding and purging, and vegetable medicines.

307—304 *Alexandrian School.*—304. Erasistratus (pupil of Chrysippus) opposed
bleeding; used simple medicines.—307. Herophilus *of Chalcedony*, a
285 demi-empiric, used compound and specific medicines.—285. Medicine
divided into *dietetics*, *pharmacy*, and *surgery*.

384—322 NATURAL HISTORIANS. 384—322. Aristotle; wrote on animals (also
371—286 on plants and pharmacy).—371—286. Theophrastus, the founder of
Botany.

290 EMPIRIC SECT (*experience the sole guide*) 290, founded by Philinus *of*
240 *Cos* (disciple of Herophilus).—240. Serapion of Alexandria.—230.
230 Heraclides *of Tarentum* ("*Prince of Empirics*") used conium, opium,
140 and hyoscyamus, as counter-poisons. Nicander *of Colophon*, wrote on
135—63 poisons and antidotes; his Θηριακά and Ἀλεξιφάρμακα still extant.—135 to
63. Mithridates; his supposed antidote (*Mithridatium Damocratis*)
158 contained 54 substances.—158. Zopyrus employed a general antidote
(*Ambrosia*); classified medicines according to their effects. Cratevas, a
138 botanist.—138. Cleophantus described medical plants.

160 *Gentian* first used by Gentius, king of Illyria.

B.C.

100 METHODIC SECT.—100. Asclepiades *of Bithynia* rejected all previous opinions, and termed the Hippocratean system "*a meditation on death*."—63. Themison *of Laodicea*, pupil of Asclepiades, founder of the sect. Explained all physiological and pathological doctrines by the *strictum* and *laxum* of the organic pores, and regarded all medicines as astringents or relaxants. Employed leeches.

A.D.

54? Pedacius Dioscorides. The most renowned of all the old writers on Materia Medica. His work is the best (of the ancient ones) on the subject, and for 1600 years was regarded as the first authority. "In him I counted about 90 minerals, 700 plants, and 168 animal substances, that is 958 in all, without reckoning the different simples the same substance often affords." (Alston, *Lect.* i. 15.) Dr. Sibthorp visited Greece for the purpose of studying on the spot the Greek plants of Dioscorides. (*Flora Græca*; and *Prodr. Fl. Græcæ*, by Sir J. E. Smith.)

131—200 Claudius Galen, a brilliant genius of vast erudition and rare talents. Explained the operation of medicines by reference to their elementary qualities (heat, cold, dryness, and moisture), of each of which he admitted four degrees. This doctrine was held in the schools until the time of Paracelsus.

4. *From Galen to the fall of the Greek School.*

A.D. (Minor Greek Authors.)

360 Oribasius.

550 Aetius. Employed musk medicinally.

560 Alexander Trallianus. First mentions rhubarb. Notices hermodactyl. Used mild laxatives.

600–700 Paulus Ægineta. First notices the purgative properties of rhubarb. Distinguishes between *Rha* and *Rheon*. Describes the effects of hermodactyl.

1034 Simeon Seth. Notices camphor.

1100–1300 John Actuarius. Mentions capsicum (κάψικον).

Nicholas Myrepsus.

ROMANS or ITALIANS.

A.D. In the early periods of Roman History medicine was practised by slaves and freedmen.

23 Menecrates. Employed escharotics. Invented Diachylon plaster.

13—55 A. Cornelius Celsus. *De Medicina.* A methodist? An elegant writer. Lays down hygienic rules. Distinguishes foods according to the degree of their nutritive power and digestibility. His remarks on these subjects, as well as on the use of remedial agents generally, display great judgment. Speaks of the use of nourishing clysters, gestation, baths, frictions, &c. Employed in dropsy frictions with oil.

41 Scribonius Largus. An empiric. His work (*Compositiones Medicæ*) is the first pharmacopœia known.

23—79 Caius Pliny the Elder. A natural historian. In his work (*Historia Naturalis*) he has collected all that was known in his time, of the arts, sciences, natural history, &c. He displays prodigious learning and a vast fund of erudition. In Botany and Materia Medica he has copied almost verbatim the remarks of Theophrastus and Dioscorides.

230 Cælius Aurelianus. A methodist. The only one of this sect whose works have descended to us.

PERSIAN MEDICINE.

B.C.

1491 Must be very ancient, but its history scarcely known. Products of Persia (ex. galbanum, assafœtida, sagapenum, &c.) mentioned in the Bible or by Hippocrates: it is to be presumed that the Persians knew the medicinal qualities of their indigenous drugs, previous to selling them.

B.C.
400 Ctesias of Cnidus, physician for seventeen years to Artaxerxes Mnemon.
A.D. 272 Dschondisabour (Jondisabur or Nisabur) founded. Greek physicians sent by the Emperor Aurelian.
Almanzor, the second caliph of the house of Abbas, a great encourager of the sciences and medicine.

ARABIANS.

A.D.
767 Bagdad built. The sciences munificently patronised by the caliphs. A college formed. Hospitals and dispensaries established.
Schools of Damascus and Cordova.
The doctrines of Hippocrates and Galen taught. Mild laxatives (as cassia, tamarinds, manna, rhubarb, and senna) substituted for drastics. Chemical medicines mentioned. Various pharmaceutical preparations (syrups, juleps, conserves, loochs, robs, and distilled waters and oils) contrived. Dispensatories published.
622 Aaron or Ahron (*The Pandects*).
Died 872 Ebn-Sahel (Sabor) *Krabadin*, the first dispensatory.
Died 880 J. Alkhende. Wrote on the proportion and doses of medicines.
Born 702 Geber, "The Patriarch of Chemistry." Mineral acids, alkalies, and many alkaline and metallic salts, are noticed by him. (See *Hindoo Medicine.*)
Died 846
865 John Mesue. *De simplicibus et de electuariis.*
900
742 John Serapion, jun. *De simplicibus medicinis.*
1066
Abn Guefith or Abhen Gnefith. *De simplic. medicam. virtut.*
852 to 932 Rhazes. *De simplicibus medicinis.* One of the most celebrated Arabians. Employed mercurial ointment.
978 to 1036 Ebnsina or Avicenna, "The Prince of Physicians." (*Canon medicinæ.*) For five centuries his work was regarded as an infallible guide. Mentions croton tiglium, camphor, nux vomica, mace, nutmegs, &c.
980 Haly Abbas. (*Almalek, or the Royal Book.*)
1179 ? Avenzoar at Seville in Andalusia.
Died 1198
or 1199 Averhoes, a native of Cordova.
1206
A.D.
12th or 13th
century Albucasis or Alsaharavius. Mentions the preparation of rose water.
1085
Died 1248 Abn Bitar or Ibn Beitar. His works have not been printed, but they are constantly quoted by Persian authors on Materia Medica. (Royle, *Essay*, p. 28.) He has a most extensive influence in the East.

⁂ Consult,—P. J. Amoreux, "Essai Historique et Litter. sur la Médec. des Arabes." Montp. 1805. 8vo. J. J. Reiske, "Opusc. Med. ex Monum. Arabum et Ebræorum." Halæ, 1776. 8vo.

Oriental (Arabian, Persian, and Hindoo) Works on Pharmacology, which have been translated.
1055 Abu Mansur Movafik. *Liber fundam. Pharmacol.* Lat. trans. by R. Seligmann. Vindob. 130—33.
Pharmacopœai Persica, ex idiomate Persico in Latinum conversa. Paris, 1681.
1628 Nouraddeen Mohammed Abdullah Shirazy. *Ulfáz Udwiyeh, or the Mat. Med. in the Arab. Pers. and Hindevy lang.* Eng. transl. by F. Gladwin. Calc. 1793.
1669 Meer Mohummud Moomin. *Toohft al Moomineen.*
1769 *Mukhzun al Udwick*, or *Storehouse of Medicines.* Hoogly. 1824. 2 vols. small fol.
Taleef Shereef, or *Indian Materia Medica.* Calc. Eng. trans. by G. Playfair, 1833. 8vo.

⁂ Consult,—W. Ainslie, "Mat. Ind." 1826. A copious list of Oriental works in vol. ii. p. 491 et seq.

EARLY CHRISTIAN WRITERS ON MEDICINE.

(Dark Ages.)

Medicine practised by monks. Magic and astrology employed in medicine. The period of superstition and alchemy. The grossest impositions practised.

The Neapolitan *schools of Monte-Cassino* and *Salerno* founded by Benedictine monks.

A.D. Constantine *the African.* Wrote on diet, and simple and eye medicines.

1100 John of Milan, Author of *Medicina Salernitana.*

1110 Nicholas, surnamed Præpositus. *Dispensatorium ad aromatarios;* the first European pharmacopœia.

1150 Matthew Platerius. 1169. Ægidius of Corbeil.

1180 Hildegard, Abbess of Bingen. Born 1098. Wrote on medicines. Mentions *Christiana* (supposed to be *Helleborus niger.*)

1259 Gilbert, an Englishman. Prepared acetate of ammonia and oil of tartar *per deliquium.* Extinguished mercury by saliva.

1193—1282 Albertus Magnus. An alchemist. Mentions zinc.

1260 John of St. Amand. Commented on the work of Nicholas.

1214—1284 Roger Bacon. The most philosophical of the alchemists.

1240—1313 Arnold of Villa Nova. Wrote a commentary on the Medicina Salernitana. Prepared the oils of turpentine and rosemary.

1235—1315 Raymond Lully. Prepared the oil of rosemary, acetate of lead, ammonio-chloride of mercury, nitric oxide of mercury, and spirit of wine.

1295 Simon de Cordo. 1317. Matthew Sylvaticus. 1320. (death) Peter
1320 de Apono. 1328. Francis of Piedmont. 1343. Dondis, father and
son.

1343 John Platerius. *Antidotarium Nicolai cum expositione.*

St. Ardouin. Red oxide of mercury.

Born 1394 Basil Valentine. Prepared chemical medicines. Introduced antimonials (*currus triumphalis antimonii*). Was acquainted with the double chloride of iron and ammonia, and the acetates of lead.

1418 Valescus de Tarenta.

1491 *Ortus sanitatis* (first botanical figures.)

1492 Columbus discovers America. Tobacco and its use for smoking first known.

1497 Mercury employed externally in syphilis.

1508 Guaiacum introduced into Europe by the Spaniards.

1493—1541 Paracelsus. A vain, ignorant, arrogant, drunken quack, fanatic, and impostor. He burnt publicly the works of Galen and Avicenna, declaring that his shoe-strings possessed more knowledge than those two celebrated physicians, and asserted that he possessed the elixir of life! He was a cabalist, astrologer, and believer in the doctrine of signatures. He conferred several important benefits on medicine: he overturned Galenism, introduced chemical medicines (employing mercury in syphilis), and substituted tinctures, essences, and extracts, for various disgusting preparations.

1530 Sarsaparilla first appeared in Europe.

Early *botanists* in whose works several medical plants are distinctly referred
to, in some cases for the first time. 1530. Brunfelsius; *Cardamine*
1532 *pratensis; Scrophularia nodosa.* 1532. Tragus; Foxglove (*Campanula*
1542 *sylvestris*); Belladonna (*Solanum hortense nigrum*), Dulcamara. 1542.
Fuchsius; Stramonium; Digitalis.

1579 Winter's bark brought to Europe.
1633 Serpentary root noticed by Thomas Johnson.
1675 Sulphate of magnesia obtained from Epsom waters by Dr. Grew.
1740 Spigelia as an anthelmintic made known.
1742 Senega introduced by Dr. Tennant.
1758 Kino described by Dr. Fothergill.
1763 Bark of salix alba used by Rev. Mr. Stone.
1788 Angostura bark imported into England.

THE BRITISH ISLES.

1. *Ancient British Medicine.*

(To the end of the 5th century A.D.)

MEDICINE OF THE ANCIENT BRITONS. Medicine and surgery practised by the Druids, who employed charms and certain medicinal agents (for which they entertained a superstitious veneration), and practised the simpler operations of pharmacy.

Their chief medicines were the misletoe of the oak, selago, vervain, and samolus. To the serpent's egg (*anguinum*) they ascribed supernatural powers.

2. *Mediæval British Medicine.*

(From the end of the 5th to the end of the 15th century A.D.)

ANGLO-SAXON MEDICINE. Medicine and surgery practised by women, and subsequently by ecclesiastics and leeches (*medici, chirurgi*). They employed a variety of superstitious practices, and ascribed the virtues of drugs to imaginary (planetary, sol-lunar, &c.) influences. Their principal medicines were herbs.

Their chief (MS.) works on medicines which were in use at this period were the following: —

1. L. Appuleii, *de Herbarum virtutibus Historia.* (It pretends to contain the doctrines which Chiron the Centaur taught to Achilles.)
2. *De Betonica.* (This work has been ascribed by some to L. Appuleius, by others to Antonius Musa.)
3. *Medicina animalium.* (Ascribed to Sextus Philosophus.)

(From the end of the 11th to the end of the 15th century.)

ANGLO-NORMAN AND EARLY ENGLISH MEDICINE. During this period medicine, and especially the *Materia Medica*, began to be studied as a science. At first the chief teachers and practitioners were ecclesiastical; but gradually the practice of medicine became transferred to laymen, and the distinction between physicians, surgeons, and apothecaries was established. Alchymy was sedulously pursued at this time.

Subsequently to the Crusades (A.D. 1096—1248) spices, gums, and other oriental substances were introduced into medicinal use, and thus the grocers who supplied these became apothecaries. The early grocer-apothecaries to the crown were foreigners. In A.D. 1231 there existed a fraternity of *pepperers*: in A.D. 1345 the *grocers* were incorporated; and in A.D. 1456 they fined one John Ayshfelde six shillings and eight pence "for makynge of untrewe powder of gynger, cynamon and saunders."

A.D.

1210 Gilbertus Anglicus (by some called *Gilbertus Legleus*), author of *Compendium Medicinæ.* (Prepared a solution of acetate of ammonia and oil of tartar *per deliquium.*)

1214 Roger Bacon. (The most philosophical of the alchymists. Described the
1292 method of making tinctures and elixirs, and laid down rules for diet and medicines.)

1320 John of Gaddesden, author of the *Rosa Anglica.* (Discovered the method of bleaching wax, of making *saccharum penidium*, of producing fresh from salt water by repeated percolation through sand, and by distillation, &c. &c. His work abounds in recipes for every complaint; and affords the best history of what medicines were in use in his time; but it is characterised by the ignorance and superstition of the age, and by the grossest quackery.)

3. *Modern British Medicine.*

(From the end of the 15th century A.D. to the present time.)

English Medicine. Establishment of the scientific study of medicine. Statutes passed for the regulation of the practice of medicine. Charters granted for the incorporation of the various orders of the profession. Employment of chemical medicines.

Statutes, Charters, &c.

A.D.

1511 The examination and admission of physicians and surgeons by the bishop of the diocese, aided by members of the faculty, 3 Hen. 8, c. 11.

1518 Incorporation of the Royal College of Physicians of London by charter.

1522 Charter confirmed by statute. Examination and admission to the exercise of physic in England vested in the College, 14 and 15 Hen. 8, c. 5.

1540 Physicians to examine drugs, 32 Hen. 8, c. 40.

Surgeons incorporated with the barbers, 32 Hen. 8, c. 42.

1542–3 Ministration of medicines for external diseases allowed to every one, 34 and 35 Hen. 8, c. 8.

1553 Wardens of the grocers to go with the physicians to examine "poticary wares, drugs, and compositions," 1 Mar. sess. 2, c. 9.

1606 Apothecaries incorporated with the grocers.

1605 The apothecaries separately incorporated by the name of the "Master, Wardens, and Society of the Art and Mystery of Pharmacopolites of the City of London." Charter, 13. Jac. 1.

1745 The union of barbers and surgeons dissolved, and the surgeons separately incorporated, 18 Geo. 2, c. 15.

1800 Charter of incorporation of the Royal College of Surgeons, 40 Geo. 3, 22nd March, 1800.

Charter altering titles of Master, &c. to President, 3 Geo. 4, 13th Feb. 1822.

Charter creating class of Fellows, 7 Vic., 14th Sept. 1843.

1815 Apothecaries' act. No person (except those previously in practice) to practise as an apothecary in England or Wales without examination, 55 Geo. 3, c. 194.

1843 Incorporation of the Pharmaceutical Society of Great Britain.

GENERAL PHARMACY.

(*Operations and Instruments.*)

1723 John Quincy, M.D. *Prælectiones Pharmaceuticæ, or a Course of Lectures in Pharmacy, Chymical and Galenical, explaining the whole doctrine of that Art.* Edited by Dr. P. Shaw. Lond. 1723. 4to.

1758 [R. Dossie]. *The Elaboratory laid open, or the Secrets of Modern Chemistry and Pharmacy revealed.* Lond. 1758. 8vo. (Published anonymously.)

1826 Samuel Frederick Gray. *The Elements of Pharmacy, and of the Chemical History of the Materia Medica.* Lond. 1826. 8vo.

1831 Robert Kane, M.D. *Elements of Practical Pharmacy.* Dubl. 1831. 12mo.

1849 Francis Mohr and Theophilus Redwood. *Practical Pharmacy.* Lond. 1849. 8vo. Amer. edit. by W. Procter, Jun., Philad. 1849.

⁂ A summary of the Theory and Practice of Pharmacy is contained in the *Dispensatories* of Quincy, James, Lewis, Duncan, and A. T. Thomson: also in the *Elements of Materia Medica and Pharmacy* of O'Bryen Bellingham, M D. (see *post*, p. 12.)

Much useful information on the subject will also be found in Aikins' *Dictionary of Chemistry and Mineralogy.* 2 vols. Lond. 1807. 4to.; and in Gray's *Operative Chemist.* Lond. 1828. 8vo.

1852 J. Bell. *Chemical and Pharmaceutical processes.*

Herbals and other works on Medical Botany.

W. C. *A boke of the propreties of herbes called an Herball, drawen out of an auncyent booke of phisyck.* Lond. 8vo.

1550 Anth. Askam. *A Lytel Herball of the properties of herbes.* Lond. 1550. 12mo.

1551 Wm. Turner. *A new Herball.* Lond. 1551. fol.—2nde parte. Collen. 1562. —3rde parte. Collen. 1568. fol.

1561 *The Greate Herball.* 1561.

1579 Wm. Langham. *The Garden of Health, conteyning the vertues and proverties of all kinds of simples and plants.* Lond. 1579. 4to.—Lond. 1633. 4to.

A.D.

1597 John Gerarde. *The Herball, or Generall Historie of Plantes.* Lond. 1597. fol.—Enlarged by Thomas Johnson. Lond. 1633. fol. (wood-cuts.)

1640 John Parkinson. *Theatrum botanicum, the Theater of Plants, or an Herball of a large extent.* Lond. 1640. fol. (wood-cuts.)

1653 Nicholas Culpeper. *The English Physitian enlarged.* Lond. 1653. 8vo.—Edited by Parkins. Lond. 1809? 1826?

1673 John Archer. *A compendious Herbal.* Lond. 1673. 8vo.

1694 John Pechey. *The compleat Herbal of physical plants.* Lond. 1694. 8vo.

1702 Dr. Richd. Mead. *A Mechanical Account of Poisons.* 5th ed. 1756. 8vo.

1722 Joseph Miller. *Botanicum officinale, or a compendious Herbal.* Lond. 1772. 8vo.

1723 G. Knowles. *Materia Medica botanica.* Lond. 1723. 4to.

1723—1728 Patrick Blair, M.D. *Pharmaco-botanologia.* Lond. 1723—1728. 4to.

1735 John K'eogh. *Botanologia universalis Hibernica, or a general Irish Herbal.* Corke, 1735. 4to.

1737 Elizabeth Blackwell. *A curious Herbal, containing 500 cuts of the most useful plants, which are now used in the practice of physick; to which is added a short description of the plants and their common uses in physick.* Lond. 1737. fol. (copper-plates.)

1747 Thomas Short. *Medicina Britannica, or a treatise on such physical plants as are generally to be found in the fields or gardens in Great Britain.* Lond. 1747. 8vo.

1755 John Hill, M.D. *The Useful Family Herbal.* Lond. 1755. 8vo.

Timothy Sheldrake. *Botanicum Medicinale, an Herbal of Medicinal Plants on the College of Physicians' list.* Lond. fol. (coloured copper-plates.)

1775 Dr. Wm. Withering. *Account of the Foxglove.* 8vo. Birm.

1782 Dr. W. Saunders. *Observ. on Red Peruv. Bark.*

1790 William Meyrick. *The new Family Herbal, or domestic physician.* Birmingham, 1790. 8vo. (copper-plates.)

1790—1794 William Woodville, M.D. *Medical Botany.* Lond. vol. i. 1790; vol. ii. 1792; vol. iii. 1793; vol. iv. 1794. 4to.—2nd ed. 1810.—3rd ed., in 5 vols., by Hooker and Spratt. Lond. 1832. (copper-plates.)

1793 Dr. J. Alderson. *Essay on Rhus Toxicodend.* 8vo.

1794 Dr. J. Relph. *Inq. into the Med Effic. of Yellow Bark.*

1809 *A Pract. Mat. Medica.* Lond. small 8vo.

1812 Jonathan Stokes, M.D. *A Botanical Materia Medica; consisting of the generic and specific characters of the plants used in medicine and diet, with synonymes and references to medical authors.* 4 vols. Lond. 1812. 8vo.

1817—1819 [Thomas Cox.] *Medical Botany* (Linnean system). 4 vols. Lond. 1817—1819. royal 8vo. (copper-plates.)

1827—1830 *Flora Medica.* 2 vols. Lond. 1827—1830. 8vo.

1829 Dr. Robt. Christison. *Treat. on Poisons.* 8vo. 2nd ed. 1835. 4th 1845.

1831 John Stephenson, M.D., and James Morss Churchill. *Medical Botany.* 4 vols. Lond. 1831. royal 8vo.—2nd ed. by Gilbert Burnett. Lond. 1834—1836. (200 coloured engravings.)

1832 Dr. J. Stephenson. *Med. Zoology and Mineralogy.* 8vo. 1832.

1838 John Lindley, Ph. D. *Flora Medica; a botanical account of all the more important plants used in medicine in different parts of the world.* Lond. 1838. 8vo.

Dispensatories.

(Containing the natural and medicinal history of the various substances.)

1718 John Quincy, M D. *Pharmacopœia officinalis et extemporanea, or a complete English Dispensatory.* Lond. 1718. 8vo.—12th ed. 1742.—14th ed. 1769.

1747 Robert James, M.D. *Pharmacopœia Universalis, or a New Universal English Dispensatory.* Lond. 1747. 8vo.—2nd ed. 1752.

1753 [William Lewis, M.B.] *The New Dispensatory.* Lond. 1753. 8vo. (Author's name omitted.) 3rd ed. Lond. 1770. (After the author's death several editions were published in London: 5th ed. 1785; 6th ed. 1799.)—In Edinburgh improved editions, forming the *Edinburgh New Dispensatory,* were published successively by Dr. Webster (1786), Dr. Duncan (1788), Dr. Rotheram (1794; 6th ed. 1801), and Dr. Duncan, Jun. (1800; 3rd 1806.)

1800 Andrew Duncan, Jun., M.D. *The Edinburgh New Dispensatory.* Edinb. 1800. 8vo.—11th ed. 1826.—*Supplement.* Edinb. 1829. 8vo.

A.D.

1811 Anthony Todd Thomson, M.D. *The London Dispensatory.* Lond. 1811. 8vo.—9th ed. 1837.—10th ed. 1844.
1813 John Thomson, M. D. *The Edinburgh New Dispensatory.* Edinb. 1813. 8vo.
1815 S. Rootsey. *General Dispensatory.* 12mo. Brist.
1824 Thomas Cox, M.D. *New London Dispensatory.* Lond. 1824. 8vo.
1842 Robert Christison, M.D. *A Dispensatory, or a Commentary on the Pharmacopœias of Great Britain.* Edinb. 1842. 8vo.—2nd edit. Edinb. 1848. American edition by R. E. Griffith, Phila. 1848.
1852 Thomson's *Conspectus of the British Pharmacopœia.* By E. L. Birkett, 16th ed. 1852.
——— *London Dispensatory.* Revised by A. B. Garrod. 11th ed. 8vo. 1852.
1853 Branston, T. F. *Druggists' Hand Book of Practical Receipts.* 1853.
Chapman, E. *Manual of Materia Medica, Pharmacology, Toxicology.* 2d ed. 1853.
1854 Garrod, A. B. *Essentials of Materia Medica for the Use of Students.* 1854.
1856 Royle's *Manual of Materia Medica, &c.* 3rd ed. 12mo. 1856.

National Pharmacopœias.

1618—1836 *Pharmacopœia* Londinensis. (The first edition of this work appeared in 1618. Subsequently numerous reprints and editions have been published; viz. in 1621, 1627, 1632, 1639, 1650, 1651, 1677, 1678, 1682, 1699, 1720, 1721, 1722, 1724, 1731, 1736, 1745, 1746, 1747, 1748, 1757, 1762, 1763, 1771, 1786, 1787, 1788, 1809, 1815, 1824, 1836, and 1851.)

⁂ Numerous translations and criticisms of these various editions have from time to time been published. The following require to be specially noticed:—

1691 Dr. G. Bate. *Pharmacopœia Bateana,* by Fuller. 12mo.
1809 R. Powell, M D. *The Pharmacopœia of the Royal College of Physicians of London,* 1809. *Translated with notes.* Lond. 1809. 8vo.
1810 J. Bostock, M.D. *Remarks on the Nomenclature of the New London Pharmacopœia.* Liverpool, 1810. 8vo.
1811 R. Phillips. *An Experimental Examination of the last edition of the Pharmacopœia Londinensis, and of Dr. Powell's translation.* Lond. 1811. 8vo.
1818 Gray's *Supplement to the Pharmacopœias.* 3rd ed. 1824.—4th ed. by Theophilus Redwood. Lond. 1848. 8vo. (pp. 1070.)
1824 R. Phillips. *A Translation of the Pharmacopœia of the Royal College of Physicians of London,* 1824. *With notes and illustrations.* Lond. 1824. 8vo. Lond. 1836. 8vo.—3rd ed. 1838.—4th ed. 1841.—5th. 1848.—6th. 1851.
1826 J. Rennie. *New Supplem. to the Pharmacopœias.* 8vo. 4th ed. 1837.
1830 F. Barker, M.D., and W. F. Montgomery, A.M., M.D. *Observations, Chemical and Practical, on the Dublin Pharmacopœia, with a Translation annexed.* 8vo. Dubl. 1830.
1837 G. F. Collier, M.D. *A Translation of the New Pharmacopœia of the Royal College of Physicians in London. With notes and criticisms.* Lond. 1837. royal 8vo.—3rd ed. 1844.
1839 G. F. Collier, M.D. *Companion to the London Pharmacopœia.* Lond. 1839. Royal 8vo.

1721—1841 *Pharmacopœia Edinburgensis.* (The first edition of this work appeared in 1699, and subsequent ones in 1721, 1722, 1727, 1735, 1744, 1756, 1774, 1783, 1784, 1788, 1792, 1803, 1804, 1806, 1813, 1817, 1839, and 1841.)

1846 R. Phillips. *Observations on the Edinburgh Pharmacopœia* (from the *Medical Gazette, Pharmaceutical Journal,* and *Medico-Chirurgical Review.*) Lond. 1846. 8vo.
1848 Theophilus Redwood. *Gray's Supplement to the Pharmacopœia.* 2nd edition.
1849 Mohr and Redwood. *Practical Pharmacy.*

1807—1850 *Pharmacopœia Dublinensis.* (A specimen Pharmacopœia was circulated among the members of the Dublin College of Physicians in 1794, and another in 1805. The first published Pharmacopœia appeared in 1807. A new edition was published in 1826, and the last edition, revised and considerably altered, was published in 1850.)

1851 *A Translation of the New London Pharmacopœia; including also the New Dublin and Edinburgh Pharmacopœias; forming a complete Materia Medica.* By J. B. Nevins, M.D., London. Lond. 1851. Demy 8vo. (pp. 780.)

A.D.

1851 J. B. Nevins. *A Translation of the New London Pharmacopœia.* 2d edit.

1851 Peter Squire. *The New London Pharmacopœia, translated and arranged in a tabular form with the Edinburgh and Dublin Pharmacopœias.*

1852 *Conspectus of the London Pharmacopœias*, by A. T. Thomson, M.D., and E. L. Birkett, M.D.

Materia Medica and Therapeutics.

1562 William Bulleyne. *The Booke of Simples.* The first part of his *Bulwarke of defence againste all sickness.* Lond. 1562. fol. (woodcuts.)

1659—1665 Robert Lovell. Παμβοτανολογια, *or a compleat Herball.* Oxford, 1659. 12mo.—1665. 8vo.—Πανζωορυκτολογια, *sive panzoologico-mineralogia, or a compleat History of Animals and Plants.* Oxford. 1661. 8vo.

1674 Thos. Willis, M.D. *Pharmaceutica Rationalis, sive Diatriba de Medicamentorum operationibus in humano corpore.* Oxon. 1674.—Ed. 3tia. Oxon. 1679. 8vo.

1683 Walter Harris, M.D. *Pharmacologia Anti-Empirica, or a Rational Discourse of Remedies both Chymical and Galenical.* Lond. 1683. 8vo.

1687 Sir John Floyer, Knt. *Φαρμακο-βασανος, or the Touch-stone of Medicines, discovering the virtues of vegetables, minerals, and animals, by their tastes and smells.* Lond. 1687. 8vo. 2 vols.

1690 Jo. Jacob Berlu, Merchant in Drugs. *The Treasury of Drugs unlocked, or a full and true description of all sorts of Drugs and Chymical Preparations sold by Druggists.* Lond. 1690. 12mo. Lond.—2nd ed. Lond. 1724. 12mo.

1693 Samuel Dale. *Pharmacologia, seu manuductio ad Materiam Medicam.* Lond. 1693. 12mo.—Ed. 3tia. 1737. 4to.

1724 James Douglas. *Index Materiæ Medicæ, or a Catalogue of simple Medicines.* Lond. 1724. 4to.

1730 R. Bradley. *A Course of Lectures upon the Materia Medica, Ancient and Modern.* 8vo.

1751 J. Hill, M.D. *A History of the Materia Medica.* 4to. Lond. 1751.

1761 Wm. Lewis, M.B. *An Experimental History of the Materia Medica.* Lond. 1761 4to.—4th ed. in 2 vols. 8vo. by Dr. Aikin in 1791.

1770 Andrew Duncan, M.D. *Elements of Therapeutics.* Edinb. 1770. 8vo.

1770 Charles Alston, M.D. *Lectures on the Materia Medica.* 2 vols. 1770. 4to.

1770 Dr. D. Monro. *Treat. on Mineral Waters.* 8vo. 2 vols.

1775 J. Rutty, M.D. *Materia Medica, Antiqua et Nova.* Rotterod. 1775. 4to.

1780 Dr. John Brown. *Elementa Medicinæ.* Regarded all medicines as stimulants, and as differing from each other in little more than the degree in which they exert their stimulant power. (*Brunonian theory.*)

1781 F. Home, M.D. *Methodus Materiæ Medicæ.* 1781. 12mo.

1785 John Aikin, M.D. *A Manual of Materia Medica.* Yarmouth. 1785. 8vo.

1788 Donald Monro, M.D. *A Treatise on Medical and Pharmaceutical Chemistry and the Materia Medica.* Lond. 1788. 3 vols. 8vo.

1789 William Cullen, M.D. *A Treatise of the Materia Medica.* 2 vols. Edinb. 1789. Amer. ed. by Benj. S. Barton, M.D.

1792 J. Moore. *Essay on the Mat. Med.* 8vo.

1794 Richd. Pearson, M.D. *Thesaurus Medicaminum.* Lond. 1794. 8vo.—4th ed. 1810.

1794—1795 Dr. Thos. Beddoes and Jas. Watt. *Consid. on the Use of Factitious Airs.* 3 pts.

1797 Richd. Pearson, M.D. *A Practical Synopsis of the Materia Alimentaria and Materia Medica.* Lond. 1797. 8vo.—2nd edit. 1808.

1800 Dr. Wm. Saunders. *Treat. on Mineral Waters.* 8vo.

1800 John Pearson. *Observ. on the Effects of var. articles of the Mat. Med. in the cure of Lues Venerea.* 8vo.

1801 Dr. G. Pearson. *Arrang. Catal. of the Art. of Food, Drink, Seasoning and Medicine.* 8vo.

1804 John Murray, M.D. *A System of Materia Medica and Pharmacy.* Edinb. 1804. 8vo.—5th ed. 1828. 2 vols. 8vo. Amer. edit. by N. Chapman, M.D.

1805 Jeremiah Kirby, M.D. *Tables of the Materia Medica, or a Systematic Arrangement of all the Articles admitted by the Colleges of London, Edinburgh and Dublin*, &c. Edinb. 1805. 12mo.

1805 Dr. J. Hamilton. *Observ. on Purgative Med.* 8vo.

A. D.

1809 *A Practical Materia Medica.* Lond. 1809. Small 8vo.

1812 J. A. Paris, M.D. *Pharmacologia.* 8vo. Lond. 1812.—6th ed. 1825.—9th ed. 1843. Am. ed. from 9th Lond., with notes by C. A. Lee, M.D., New York, 1844.

1813 Dr. W. Ainslie. *Mat. Med. of Hindostan.* 4to.—*Mat. Indica.* 2 vols. 8vo. 1826.

1813 Dr. Thos. Young. *Classif. and Lit. of Mat. Med. in the Introd. to Med. Lit.* 8vo.

1825 William Thomas Brande. *Manual of Pharmacy.* Lond. 1825. 8vo. 3rd ed. 1833.

1832 Anthony Todd Thomson, M.D. *Elements of Materia Medica and Therapeutics.* 8vo. Lond. 1832–3. 2 vols. 8vo.—2nd ed. in 1 vol. 1835.—3rd ed. Lond. 1843.

1833 Thomas Wharton Jones. *Manual of Pharmacology.* Lond. 1833. 18mo.

1835 J. Johnstone, M.D. *A Therapeutical Arrangement and Syllabus of Materia Medica.*

1835—1837 Jonathan Pereira, M.D. *Lectures on Materia Medica and Therapeutics.* (In the *London Medical Gazette.*)

1836—1838 G. G. Sigmund, M.D. *Lectures on Materia Medica and Therapeutics.* (In the *Lancet.*)

1837 John Steggall, M.D. *A Text Book of Materia Medica and Therapeutics.* Small 8vo.

1838 Alexander Ure. *A Practical Compendium of Materia Medica (with numerous formulæ) adapted for the Treatment of the Diseases of Infancy and Childhood.*

1839 W. T. Brande. *Dictionary of Materia Medica and Practical Pharmacy.* Lond. 1839. 8vo.

1839—1840 Jonathan Pereira, M.D. *The Elements of Materia Medica and Therapeutics.* 8vo. Part i. 1839; Part ii. 1840.—2nd ed. 1842.—3rd ed. 1849. 3d Amer. ed. by J. Carson, M.D. Philad. 1852–4.

1840 J. H. Lane. *Compendium of Materia Medica and Pharmacy.* Lond. 1840. 18mo.

1840 R. H. Black. *Student's Pharmaceutical Guide.*

1840 C. Parry. *Elements of Therapeutics.*

1840 A. Kilgour. *Lectures on Therapeutics.*

1840 Dr. Martinet. (*Translation.*) *Manual of Therapeutics.*

1840 D. Spillan. *Manual of Therapeutics.*

1840 T. Marryat. *Therapeutics; or, Art of Healing.*

1841 O'Bryen Bellingham, M.D. *Elements of Materia Medica and Pharmacy.* Edited by A. Mitchell, M.D. Part I. Dubl. 1841. 8vo.

1845 Edward Ballard, M.D., and Alfred Baring Garrod, M.D. *Elements of Materia Medica and Therapeutics.* Lond. 1845. 8vo. Amer. ed. by R. E. Griffith, M.D. Philad.

1846 J. Forbes Royle, M D. *A Manual of Materia Medica and Therapeutics.* Lond. 1847. Fcp. 8vo.—2nd. ed. 1853. 3d ed. 1856. Amer. ed. by J. Carson, M.D., Philad. 1847.

1847 J. Moore Neligan, M.D. *Medicines, their uses and mode of administration.* Dubl. 8vo.—2nd ed. 1847.—3rd ed. 1851. Amer. ed. 1 vol. 8vo. New York.

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Diss. Upsal. 1831. 4to. pp. 12.
1832 *Veterinaire Pharmacopoe.* Stklm. 1832. 8vo. pp. 51.
J. H. Forshæll, *Om Medicinal Wäxters Odling,* &c. Stklm. 1832. 8
pp. 28.
1833 J. F. Sacklén, *Sveriges Apothekare Historia.* Nyköping, 1833. 8vo. pp. 4
1834 M. Huss J. C. Wretholm, *Om möjligheten att enligt Vegetabiliernas natur*
analogier a priori bestämma deras egenskaper och verkningar. Diss. i.
Upsal. 1834. 8vo. pp. 31.
Pharmacopæia in Usum Nosocomii militaris. Holmiæ. 1834. 8vo. pp. 32.
J. E. Flodberg and Elis Hedrén, *De Camphora. Diss.* Upsal. 1834.
pp. 16.
P. I. Eckman, *De Papavere Somnifero. Diss.* P. i. Upsal. 1834. 8
pp. 16.
1835 F. G. Björnlund, *Handbok för Pharmaceuter.* Uddewallæ. 1835. 8
pp. 24.
1836 J. H. Forshæll, *Om Pharmaci Werket i Sverige.* Stklm. 1836.—Lund. 18
8vo. pp. 24.
——————— *Lärobok i Pharmacien.*
Organ. Pharm. Narrköping. 1836. 8vo. pp. 394.
Organ. Pharm. Lund. 1838. 8vo. pp. 229.
N. J. Berlin, *Circa Præparata chemica Pharm. Svec. Observat. Diss.* Up
1836. 4to. pp. 28.
1838 G. Eriksson, *Läkemedlens Igenkännande och Pröfning.* Wexio. 1838. 8
pp. 384.
1840 *Om Apotheksväsendet.* Stklm. 1840. 8vo. pp. 25.
1841 P. O. Almström, *Apothekarekanstens Elementer.* Stklm. 1841. 8vo. pp. 27
C. W. König, *Geleers särdeles Perltängens användning i Medicin. Diss.* La
1841. 8vo. pp. 20.
1841 D. S. Högberg, *Plantæ Officinales,* tom. i. *Indigenæ Svec. Fasc.* I. xxv. *Sp*
Holmiæ. 1811. Fol.
1842 J. H. Forshæll, *Receptformlerna i Hufelands Enchiridion Medic. i Phar*
hänseende granskade, i. ii. iii. Lund. 1842. 8vo. and 12mo.
A. Andrée, *Apotheks väsendet i Sverige.* Wisby. 1842. 8vo.
1843 J. H. Forshæll, *Medico Pharmaceut. Kaleidoskop.* i. ii. Lund. 1843. 8vo.
N. P. Hamberg, *Medicinsk-Pharmaceutisk Drogue Samling.* Afd. i. Stk
1843; ii. 1844; iii. 1845; iv. 1847; v. 1848.
1844 C. G. Nyblæus, *Apotheks väsendet i Sverige,* i. ii. Upsal. 1844. 8vo. pp.
iii. iv. Jönköping. 1845. 8vo. pp. 54.
1845 C. G. Nyblæus and C. S. Wendt, *Lasning för Pharmaceuter.* i. Lund. 18
8vo. pp. 76.
1846 N. J. Berlin, *In Pharmac. Svec. Commentarius medico practic.* Lund. 18
12mo. pp. 172.
C. G. Nyblæus, *Pharmaceutisk Technologi.* Stklm. 1846. 8vo. pp. 488,
table.
1847 N. J. Berlin, *Om Atskilliga Uttländska Farmaceutiska Institutioner,* &c. L. S.
H. 1847. 8vo. pp. 80.
1848 *Förstag till Militair Pharmacopé.* Stklm. 1848. 12mo. pp. 22.
J. H. Forshæll, *Om Nya Farmakopoen.* Jönköping. 1848. 12mo. pp. 35.
1849 N. J. Berlin, *Svenska Farmacopeen öfversatt och kommenterad.* Del. i. La
1849. 8vo. pp. 751.—Lund. ii. 1851. 8vo.
1850 { A. M. Thunberg, P. G. Kihlstedt, } *Om Torkslefver Tran. Diss.* i.—
{ C. R. Senell, J. Angström, } Upsal. 1850. 8vo. pp. 66.

DENMARK.

A. D.
1640 Simon Pauli. *Quadripartitum botan. de simpl. facult.* Rostochii. 4to. Argent 1667, 1668. 1674.
1658 C. Th. Bartholinus. *Dispensat. Hafn.* Hafn. 4to.
1772—1840 *Pharmacop. Dan.* Hafn. 1772. 1786. 1805. 1840.
1788 Fr. L. Bang. *Pharmacop. in usum Nosocom. Frideric.* Havn. 12mo.
1799 C. E. Mangor. *Pharmacop. Paup.* Hafn. 4to.
1800 C. E. Mangor. *Armenapothek.* Hafn.
1804 Nicolai Tychsen. *Theoretish og praktish Anviisning til Apothekerkunsten.* Udg. ved J. F. Bergsoe. Kbhn. 1 and 2 D. 8vo.
1809—1810 O. H. Mynster. *Pharmacologie.* Kbhn. 2 D. 8vo.
1810—1812 J. C. W. Wendt. *Anviisning til at samle, törre og conservere medicinske Planter og Plantedele.* Kbhn. 8vo.
1811 J. C. W. Wendt. *Anviisning til Recepteerkunsten.* Kbhn. 8vo.
1813 *Pharmacop. milit.* Kbhn. 12mo.
1828 *Pharmacop. in praxi publ. a med. Dan. sequenda.* Hafn.
1834—1835 M. Djörup. *Haandbog i Pharmacologien.* Kbhn. 8vo. 2 D. 2 Udg. 1837, 1838.
1838 Carl Otto. *Haandbog i Toxicologien.* Kbhn. 8vo.

⁂ Many articles on Pharmacology will be found in the following Danish medical journals: —

1. "Bibliothek for Læger." 1809—1839. Kbhn. 30 vols. 8vo.
2. "Hygæia." Udvigel ved Otto. 1826, 1827.
3. "Medicinsh-chirurgische Tidskrift."
4. "Ugeskrift for Læger." 1839.

☞ For further information respecting Danish and Norwegian works on Pharmacology consult M. Winther, "Bibliotheca Danorum Medica. Hafniæ." 1832.

NORWAY.

The Danish and Norwegian literature was common to both countries until their political separation in 1814, when Norway was united to Sweden. The language used in Norway in writing, and by all educated persons, in speaking, is identical with the Danish. Hence, then, every medical work published in Denmark till 1814 may be considered as also belonging to Norwegian literature. Since that year no work on Pharmacology has been published in Norway. The king has, however, appointed a committee to prepare a new Pharmacopœia for that country. The *Pharmacopœia Danica* has hitherto been used there. Several articles on Pharmacology have appeared in the Norwegian periodical: *Eyr, et medicinsk Tidskrift.* 11 vols. Commenced in 1826, and continued by Dr. Holst till 1837.

[Since the former edition of this work was published, Dr. Holst has visited this country, and has presented us with copies of the undermentioned works.

1854 *Pharmacopœa Norvegica.* Regia auctoritate edita. Christiania.
1855 *Medicinal Taxt for Norge.* Som ifolge kongl. Placat af 10de November, 1855, er gjældende fra 1ste Januar, 1856, nidtil videre. Christiania.

The reader will find that we have introduced into this edition many of the preparations of the Norwegian Pharmacopœia, which we have reason to believe has been almost entirely drawn up by Dr. Holst. — Ed.]

RUSSIAN EMPIRE.

a. *To the end of the* 10th *century*, A. D.

Before the 11th cent. A. D.	During this epoch there were no professors of the healing art. Medicine was practised on emergencies by the heads of families (*Medicina domestica*). *Quas* employed as a national drink. Baths in popular use.

A.D. *β. From about the end of the* 10*th century to the end of the* 17*th century*, A.D.

Subsequently to the introduction of Christianity into Russia (988, A.
medicine was practised by regular professors, most of whom were foreign
(English, Dutch, and German).

990 **John Smer** or **Smera**, a Pole, the first physician mentioned by name.

1534 Herbal (in Russ.) with figures.

1553 Commencement of commercial intercourse with England during the reign
Ivan Vassillievitch. Subsequently to this period, English medical n
visited Russia; some being sent, at the request of the Czar, by the Engl
sovereign.

1581 Establishment of the Imperial Court Dispensary, in the Kreml district,
Moscow; and appointment of **James Frencham**, an Englishman, to
office of Apothecary to it.

1588 A manuscript *medicine-book* translated from the Polish into Russ. (T
Polish original bears date 1423, A.D., and states that it was a translat
from Roman authorities.)

1620 Establishment of the *Aptékarski Prikâs* or Apothecaries' Board [*Apothe*
behörde]. To this Board was committed the supervision of the court
pensary, the appointment of military surgeons, the establishment of
military dispensaries, the payment of the salaries of the medical officers,
the settlement of disputes. (In 1707 this received the name of Apo
caries' Chancery [*Apothekercanzlei*], and, in 1725, that of Medical Chanc
[*medicinischen Kanzlei*]).

1631 Military dispensaries instituted.

1657 Prohibition of private trade in rhubarb, and establishment of the Cr
monopoly. (In 1762 the monopoly ceased.)

1665 Physic gardens established at Moscow.

γ. From the commencement of the 18*th century to the present time.*

During this epoch medicine, as a science, was established and domesticate
Russia.

B. 1672 D. 1725 **Peter** the Great (who reigned alone from 1696 to 1725) greatly encoura
medicine, as well as the arts and sciences generally. He established pu
medical institutions (hospitals, schools, libraries, museums, &c.); botan
gardens, &c. — He promoted the translation of foreign medical books
the Russian language; and encouraged the establishment of chemical ma
factories.

1701—1713 Appointment of eight private dispensaries in Moscow in addition to the
Royal ones.

1721 The establishment of private dispensaries, in St. Petersburg and other pla
ordained.

1763 Foundation of the Imperial Medical College by Catherine II.

1765 *Pharmacopœia castrensis.* 8vo.

1710 1774 **John George Model**, for many years an Apothecary at St. Petersb
Author of various chemical and pharmaceutical works.

1778 *Pharmacopœia Rossica.* Petrop. 1778, 8vo. — 1782, 8vo. — 1798, 8vo. — 1
8vo. — 1800. — Rec. opus plane novum, 1803, 8vo. — Lips. 1821, 8vo. —
nov. Lips. 1830.

1778 *Pharmacopœia castrensis Rossica.* Petrop. 1778, 4to.

1784 **Dr. H. Bacheracht.** *Pharmacopœia Rossica ac Pharmacopœia castrens*
navalis Rossica. Petrop. 8vo. (A German translation, by K. F. Schr
published at Copenhagen, 1788.)

1783—1789 **Nestor Maximowitsch Ambodix.** *Materia Medica* (in Russ.). 4
with 134 plates. St. Petersburg.

1790 **Johannes Fridericus Grahl.** *Dissertatio inaug. sistens quædam medicam*
Rossorum domestica. Jenæ, 4to.

1790 **Sievers**, an apothecary, went to Siberia under the auspices of Catherine II.,
the view of promoting and improving the cultivation of Siberian rhubar

1802 [**G. Ellisen.**] *Russisch-Kaiserl. Feld-Pharmakologie*, &c. Stendal, 8vo.

1802 **D. H. Grindel.** *Pharmaceutische Botanik zum Selbstunterricht.* Riga, 1
— 2te Aufl. 1805.

1806 **F. Giese.** *Lehrbuch der Pharmacie.* Riga, 1806–1811, 8vo.

1806 **J. Roggers.** *Pharmacopœia navalis Rossica.* Petrop. 8vo.

1806 **D. H. Grindel.** *Grundriss der Pharmacie.* Riga.

1808 **D. H. Grindel.** *Taschenbuch für prüfende Aerzte und Apotheker.* Riga,

1808 *Pharmacopœia in usum Nosocomii pavp.* Petrop. 8vo.

A. D.

1808 Sir James Wylie, Bart. *Pharmacopœia castrensis Ruthenica.* Auctore Jacobo Wylie, Equite Baron. Jussu Augusti Imperatoris. Petrop. 1808, 1812, 1818; ed. 4ta, 1840, large 8vo. (Contains tables showing the composition of the Russian mineral waters.)

1814 Th. Schäffer. *A manual of the art of prescribing* (in Russ.). Moscow.

1816 C. F. U. Vollberg. *Pharmaca quædam indigena pharmacopœia, Rossicæ addenda.* Dorpat, 1816. 8vo.

1817 S. Kaschinsky. *The Russian medical Herbarium* (in Russ.). St. Petersburg.

1817 Mironovitsch. *Practical General Pharmacology* (in Russ.). Moscow.

1818 Establishment of the Pharmaceutical Society at St. Petersburg (*Pharmaceutische Gesellschaft zu St. Petersburg*) under the presidency of the Academician and State-Councillor, A. J. Scheerer.

1820 A. N. Scherer. *Versuch einer systemat. Uebersicht der Heilquellen des russichen Reichs.* Mit 11 illum. Karten. St. Petersburg. 8vo.

1825—1828 N. Stschleglow. *Economical Botany* (in Russ.) with 100 plates. 2 vols. St. Petersburg.

1829 P. Horaninow. *Systema Pharmacodynamicum.* Petrop. 8vo.

1832 Jos. Kalinski. *The art of prescribing* (in Russ.). St. Petersburg.

1835 A. M. Schwanck. *De methodo endermatico dissertatio.* Dorpat. 8vo.

1840—1842 A. Neljubin. *Pharmacography* (in Russ.). 4th edition. 4 vols. St. Petersburg.

1843 C. F. Ed. Siller. *Lehrbuch der Pharmacie.* — 1er Bd. 2te Ausg. 1848.

1843—1845 C. F. Friedemann Göbel (Professor of Chemistry and Pharmacy at the University of Dorpat). *Die Grundlehren der Pharmacie.* 3 vols. 8vo. Erlangen.

⁂ There are many Russian translations of German works on pharmacy and pharmacology; as those of Fischer, Hermbstädt, Sprengel, Trommsdorff, Sobernheim, &c.

The works of Sobernheim, Vogt, Sundelin, and Hartmann, are used as manuals in the different universities of Russia.

Pharmaceutical Journals and Transactions.

1803—1808 *Russisches Jahrbuch der Pharmacie.* Herausg. von D. H. Grindel. Riga, 6 vols. 8vo. 1803–1808. — Continued under the following title: —

1809—1810 *Russisches Jahrbuch der Chemie und Pharmacie.* Herausg. von D. H. Grindel und F. Giese. 2 vols. Riga, 1809; Dorpat, 1810.

1819—1822 *Medicinisch-pharmaceutische Blatter* von D. H. Grindel. Riga, 1819–1822. *Journal der Arzneimittellehre* von Rehmann.

1837 *Jahresbericht der pharmaceutischen Gesellschaft zu St. Peterburgh, für das J.* 1836. St. Petersburgh, 8vo.

1837—1839 *Repertorium der Chemie und Pharmacie*, von J. H. W. Schmettan. 3 Bde. St. Petersburgh.

1839—1849 *Nordisches Centralblatt für die Pharmacie und ihre Hülfswissenschaften*, redigirt von Ed. Siller. Herausgegeben von der Pharmaceutischen Gesellschaft zu St. Petersburg.

1842—1849 *Repertorium für Pharmacie und praktisches Chemie in Russland.* Herausgegeben von G. Gauger.

Russian Pharmaceutical History and Bibliography.

1813—1817 D. W. M. Richter. *Geschichte der Medicin in Russland.* Moskwa, 1813—1817. 3 vols. 8vo.

1818 Körber, Joh. Fr. *Auszug aus dem ältern u. neuern in Russland erschienen Manifesten, Ukasen, Püblicationen, &c. welche das gesammte Medicinalwesen betreffen.* In alphab. ordn. Mitau, 1818.—*Zusätze und Berichtigungen, nach des Verfassers Tode*, herausgegeben von H. Bidder. Mitau, 1825.

1839 Regulations for the Practice of Medicine and Pharmacy in Russia (*Pharmaceutical Journal*, vol. i. p. 183, 1841).

Statistical Report on the Pharmaceutical Establishments in Russia (*Pharmaceutical Journal*, vol. iii. p. 254, 1843).

1847 R. Krebel, M.D. *Russlands naturhistorische und medicinische Literatur.* 8vo. Jena. (Includes those works only which are not published in the Russian language).

1848 M. Heine, M.D. *Fragmente aus der Geschichte der Medicin in Russland.* 8vo. St. Petersburgh.

FINLAND.

A.D.
1797 B. Björnlund. *Materia Medica Selecta.* 8v
1819 *Pharmacopœia Fennica.* Large 8vo. Aboæ.

POLAND.

1817 *Pharmacopœia Regni Poloniæ.* 8vo. Varsovi
1820—1821 *Journal of Pharmacy of Wilna* (in Polish). V

Polish Pharmaceutical History and

On the State of Pharmacy in Poland, by Fra
Journal, vol. iv. p. 518, 1845.)
F. Bentkowskiego. *Historya Literatury P*
Wilnie, 1814. (The second volume contai
in Poland on chemistry, pharmacy, natural

PORTUGAL.

(From the establishment of the Monarch

1449 Privileges granted by Alfonso V. to the Apo
Portugal from Ceuta. (First legislative noti
foundation of the monarchy.)
1450 Inspection of Drugs ordained.
1461 Physicians and Surgeons prohibited from prep
prohibited from practising medicine and su
1512 Thome Pyres. *Carta escripta de Cochim a E*
1516, *sôbre algumas plantas e drogas medici*
Pharm. Lusit. t. ii. p. 36, 1838.)
1521 Examinations of Apothecaries ordained.
B. 1511 { Amatus Lusitanus, also called Johannes
D. 1568 { mented on Dioscorides.
1563 Garcia d'Orta. *Coloquios dos simples, drog*
Goa, 4to. (Latin Translation, by Clusius,
plicium aliquot medicamentorum apud Indo
8vo.—5th ed. fol. 1605 in Clusii Exoticis.—
—French Transla. 2d ed. Lyon 1619. 8vo
1641 Zacutus Lusitanus, also called Abraham
praxin et pharmacopœum. Amstel. 8vo.
1711 D. Caetano de Santo Antonio. *Pharmac*
2d ed. 1725, fol.—3d ed. 1754.
1713 D. Caetano de Santo Antonio. *Pharmaco*
lation.] 8vo. Lisbon.
1716 Joao Vigie. *Pharmacopea Ullisiponense.*
1733 Manuel Rodrigues Coelho. *Pharmacope*
1751. 3 tom. fol.
1736 Antonio Lopes da Silva. *Exame do Botic*
1741 *Promptuario Pharmaceutico-Cirurgico.* Lisbo
1745 *Thesouro Apollineo-gallenico, chymico, chirur*
de remedios para ricos e pobros. Lisboa, 4t
1768 Antonio Martins Sodré. *Collectaneo Ph*
1757—1772 Fr. Joao de Jesus Maria. *Pharmacopea*
e practica. Porto, fol. tom. i. 1757; tom. i
1772 Chair of Pharmacy established in the Univer
1785 M. J. Henriquez de Paiva. *Pharmacopea*
1787 *Medicamentorum Sylloge propria Pharma*
Conimbriæ.
1792 José Francisco Leal. *Elementos de Pha*
reduzidos a novo methodo. Lisboa, 8vo.

A. D.

1794 *Pharmacopea Geral para o Reino e Dominios de Portugal.* Tomo i. Elementos de Pharmacia; Tomo ii. Medicamentos Simplices, Preparados, e compostos. Lisboa, 2 vols. 8vo. (The first legal Pharmacopœia.)

1801 Bernardino Antonio Gomes. *Memoria sôbre a Ipecacuanha fusca do Brazil, ou Cipó das nossas boticas.* Lisboa, 1801, c. Ic.

1801 Felix Avellar Brotero. Died 1829. Wrote a description of Callicocca Ipecacuanha (*Trans. Linn. Society*, vol. vi. p. 137, Lond. 1802). Author of *Phytographia Lusitanica*, Ulyss. 1800, 2d ed. 1816, fol.; and of *Flora Lusitanica*, Ulyss. 1804, 2 vols. 8vo.

1785—1802 Manoel J. Henriques de Paiva. *Collecção dos Simples preparados e compostos mais efficazes e de maior uso.* Lisboa, 1785—1802.

1809 *Pharmacologia in usum prælectionum Academicarum Conimbricensium.* Conimbricæ, 8vo.

1810 B. A. Gomes first obtained crystallized Cinchonia. (*Ensaio sôbre o Cinchonino, e sôbre sua influencia na virtude da Quina e d' outras cascas*, published in the *Memorias da Academia Real das Sciencias de Lisboa*, tom. iii. p. 202, Lisboa, 1812, fol.—A translation of this essay was previously published in *The Edinb. Med. and Surg. Journ.* vol. vii. p. 420, 1811.)

1814 Antonio José de Sousa Pinto. *Memoria sôbre a administraçao do mercurio suas consequencias e preparaçoens.* 4to. Lisboa, 1814.

1815 Antonio José de Sousa Pinto. *Pharmacopea Cirurgica, ou Selecção de Formulas adaptadas ao uso interno e externo, em que se descrevem o uso, virtude, e dose dos remedios nas molestias a que se fazem applicaveis.* Lisboa, 8vo. (Contained in the *Vade-Mecum do Cirurgião.*)

1816 *Formulario Pharmaceutico adaptado nos Hospitaes de França.* 4to. Lisboa.

1816 Caetano José de Carvalho. *Conhecimento pratico dos medicamentos de Lewis, traducção do Francez.* 3 vols. 4to. Lisboa.

1817 Antonio Lopes de Carvalho. *Arte de formular segundo as regras de chymica pharmaceutica, ou Diccionario manual portatil para uzo dos medicos e boticarios. Traducção de A. L. de Carvalho.* 4to. Lisboa.

1819 Jacintho da Costa. *Pharmacopea Naval Castrense.* 2 vols. 4to.

1825 Jeronimo Joaquim de Figueiredo. *Flora Pharmaceutica e Alimentar Portugueza.* 8vo. Lisboa.

1786—1829 Fran. Tavares. *De Pharmacologia libellus, academicis prælectionibus accommodatus.* 12mo. Conimbricæ, 1786.—*Pharmacologia novis recognita curis aucta emendata et hodierno sæculo accommodata. In usum prælectionum Academicarum Conimbricensium.* Conimbricæ. Ex typographiâ Academico-regia. 1829.

1833 B. J. O. T. Cabral. *Pharmacopea das Pharmacopeas nacionaes e extrangeiras Tem saido.* 2º vols. 4to. Lisboa.

1835 Foundation of a Pharmaceutical Society at Lisbon.

1835 Agostinho Albano da Silveira Pinto. *Codigo Pharmaceutico Lusitano, ou Tratado de Pharmaconomia.* Coimbra, 8vo. (By a decree of the Queen, dated October 6th, 1835, this work was declared to be the legal Pharmacopœia of Portugal.)—4th ed. Porto, 1846, 8vo.

1836 A. A. da Silveira Pinto. *Pharmacographia do Codigo Pharmaceutico Lusitano.* Coimbra, 8vo.

1836 Chairs of Pharmacy and Materia Medica established in the Medico-Chirurgical Schools of Lisbon and Oporto.

1838 *Pharmacopea Lusitana feita por uma Commissão creada por Decreto de 5 de Outubro* 1838.

1841 *Formulario dos Hospitaes militares feito por uma Commissão.* 8vo.

1842 Joaquim Pedro Abranches Bizarro. *Soubeiran traducção da 2a edição com acrescentamento d' algumas formulas para exemplificar a doutrina e um resumo da Historia de Pharmacia.* 8vo. Lisboa.

1843 *Formulario dos Medicamentos para o Hospital Real de S. José feito por uma Commissão.* 4to.

1845 Candido Albino da Silva Pereira e Cunha. *Tractado de Venenos ou Toxicologia theorica e practica considerada em uma applicação á Pathologia á Medicina legal.* 4to. Lisboa. (Used in the Medico-Chirurgical School of Lisbon.)

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1. *Pharmaceutical Journals.*

Jornal da Sociedade Pharmaceutica de Lisboa, tomo i. Lisboa, 1836. *Jornal da Sociedade Pharmaceutica Lusitana*, tomo ii. 1838: tomo iii. 1842; tomo iv. 1845—7. 8vo.

A.D.
1741 S. F. Geoffroy. *Tract. de Mat. Méd.* 3 vols. 8vo.
1756 Helminthocorton sent to Paris.
1760 Thos. Goulard. *Traité sur les Effets des Prep. de Plomb.* 8vo. 2 vols.
1762 A. Baumé. *Elém. de Pharm. theor. et prat.* 2 vols. 8vo. 9me ed. 1818.
1770 Jos. Lieutaud. *Précis de la Mat. Méd.* 2 vols. 8vo.
1773 De la Beyrie et Goulin. *Dict. raisonné-univ. de Mat. Méd.* 8 vols. 8vo.
1778 Desbrest. *Traité des Eaux Minérales de Chateldon, de Vichy et Hauterive en Bourbonnais.*
1783 Macquart. *Manuel sur les Propriétés de l'Eau, particulièrement dans l'art de Guérir.*
1787 Parmentier. *Sur la Nature des Eaux de la Seine.*
1787 Venel. *Précis de Mat. Méd.* 8vo. 2 vols.
1788 Fourcroy et Delaporte. *Analyse Chimique de l'Eau Sulfureuse d'Enghien pour servir à l'Histoire des Eaux Sulfureuses en général.*
1789 Desbois de Rochefort. *Conrs Elém. de Mat. Méd.* 8vo. 2 vols.
1794 Lomet. *Mémoire sur les Eaux Minérales et les E'tablissements Thermaux des Pyrénées.*
1803 Narcotine discovered by Derosne.
1804 A. P. Decandolle. *Essai sur les Propr. Méd. des Plantes.* 8vo. 2nde ed. 1816.
J. L. Alibert. *Nouv. Elém. de Thérapeut.* 3 vols. 8vo. 5me ed. 1826.
1805 C. J. A. Schwilgue. *Traité de Mat. Méd.* 3me ed. 1818. 2 vols. 8vo.
1805 J. B. G. Barbier. *Princip. Gén. de Pharmacol.*—*Traité Elém. de Mat. Méd.* 2nde ed. 1824. 3 vols. 8vo.—4me ed. 1837.
1806 J. J. Chortet. *Traité de Pharmacologie.*
1811 Picrotoxin discovered by Boullay.
1811 J. J. Virey. *Traité de Pharm. théor. et prat.* 2 vols. 8vo. Nouv. ed. 1819.
1811 Iodine discovered by Courtois.
1812 Bidault de Villiers. *Propriétés Médicinales de la Digitale Pourprée.* 3me ed.
1814 The existence of Morphia confirmed by Robiquet.
1814 P. Orfila. *Traité des Poisons; ou, Toxicol. Gén.* 3me ed. 1827. 5me ed. 1852.
1817—1820 Pelletier and Caventou discover emetine, strychnia, brucia, veratria, and quina.
1818 J. L. M. Menard. *Essai de Mat. Méd. et de Thérap.* 8vo.
1819 C. P. Martin. *Essai de Pharm. gén.* 8vo.
1819 Caventou. *Traité Elém. de Pharm. théoriq.* 8vo.
1819—1820 Hanin. *Cours de Mat. Méd.* 8vo. 2 vols.
1820 J. J. Virey. *Hist. Nat. des Médicam. des Alim. et des Poisons.* 8vo.
1820 N. J. B. G. Guibourt. *Hist. Abrég. des Drog. simpl.* 8vo. 2 vols. 3me ed. 1836.
1821 Labarraque recommends the chlorides of lime and soda.
1821 Jos. Roques. *Phytographie Médicale.* 2 vols. 4to.
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⁂ A considerable number of pharmaceutical journals are published in Germany. The following are perhaps the most important: —

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3. J. B. Trommsdorf. *Journal der Pharmacie.* 8vo. 1794—1817. *Neues Journal der Pharmacie.* From 1817.

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5. *Pharmaceutisches Central-Blatt.* 8vo. (From 1830.) Edited by Drs. A. Weinlig and E. Winckler.

6. *Annalen der Pharmacie.* 8vo. (From 1832.) A continuation of the *Magazin für Pharmacie.* (From 1823 to 1831.)

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London:
Printed by Spottiswoode & Co.
New-street Square.

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